ELECTRICAL REVIEW

ILLUSTRATED.

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VIEWS, NEWS AND INTERVIEWS.

One of the latest marine installations of the electric light is that in the "Murex," the first of a fleet of steamers building in England for the transport of petroleum in bulk to the Suez Canal.

President C. A. Coffin, of the General Electric Company, brought over from Boston last Tuesday a party of friends to inspect his handsome new offices which had just been fitted up in the Edison building. Imagine his disgust when he encountered the wet and blackened ruins of the fire which occurred in the building early Tuesday morning.

General Manager Tucker, of the Maine Central Railroad, says the necessary money for placing the proposed electric search-light on the top of Mount Washington has been subscribed. The light will be the highest and strongest in the world, and will be seen from Maine, Massachusetts, New Hampshire, Vermont, New York and Canada.

"Look at this," said a well known electrical inventor, as he pulled a big roll of bills from his trousers pocket and displayed a 20 on the outside.

"It looks nice. Been playing the races?"

"No, sir. This is the price of one idea. I have a friend who is a large manufacturer of mechanical and electrical specialties. We know each other's inventive abilities pretty well. Sometimes he carries an idea to a certain stage of development and then gets stuck. I happen in and help him out. Its always worth from $100 to $500 to me. I don't know any easier way to make money and as I have had several opportunities of helping him out lately, I am quite flush. What'll you take?"

"Shellac, the text-books tell us, is a good insulator," said an electrical experimenter. "This is a fraud. Nearly all shellac contains water and you can't get rid of it. This, of course, lessens its insulating qualities. Gum copal is a first rate insulator and turpentine is one of the best."

Electrical apparatus for the South American export trade is built in sections each weighing under 400 pounds. The reason is that in a great many cases all supplies for a plant have to be transported on mules, and 400 pounds is about the limit of a mule's carrying capacity.

"It is becoming harder to sell electrical goods every day," mused an electric light salesman. "A few years ago, the general public knew nothing of electricity and didn't pretend to. Then all I had to watch were the prices I submitted, as the buyer was apt to take the cheapest machine, irrespective of its merits. Nowadays, everybody knows a great deal of electricity, or thinks he does, which is worse, and I have to watch my prices and disabuse his mind of fallacious ideas at the same time."

Pool rooms in Boston were swindled out of about $6,000 last week by tapped wire returns on the Coney Island Jockey Club's races. It is believed that the wires were tapped between Hartford and Providence.

The Lundell Fan Motor.

Now that the warm weather is upon us, it is a fitting time to make note of the various improvements that have been recently made in these valuable appliances which add so much to our comfort during the warm summer months. The Interior Conduit and Insulation Company, of New York, are bringing out an entirely new form of fan motor, the invention of Mr. Robert Lundell, who is connected with the company. The practical elimination of all magnetic leakage constitutes the chief factor of superiority claimed for the new Lundell motor, although it is not the only one.

This great desideratum is attained in the following manner, as shown in Fig. 3. The armature and pole pieces are surrounded by a single magnetizing coil, which, in turn, is itself totally surrounded by the keeper or yoke, thus leaving no chance for stray magnetism. It is a true iron-clad field magnet, having at the same time the shortest possible magnetic circuit. The keeper would form a perfect sphere were it not for the slight projections constituting the bearings.

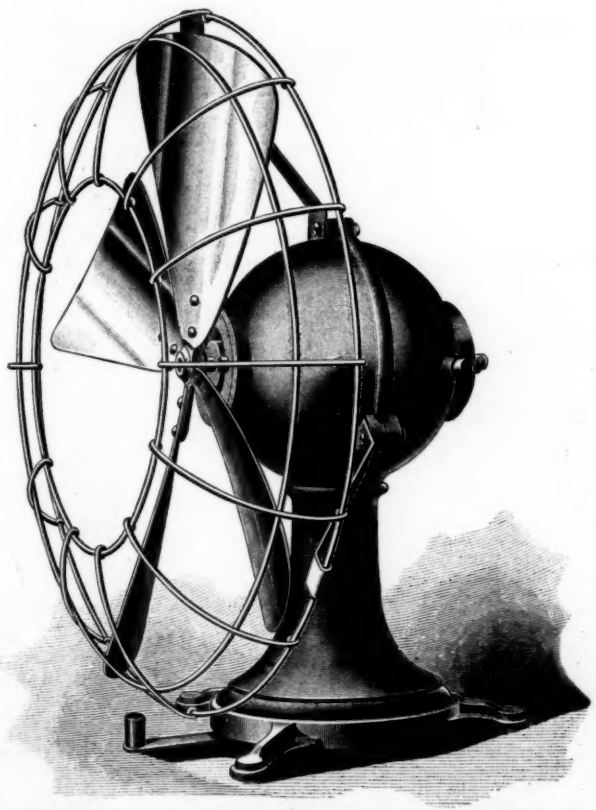

FIG. 1.—ONE-SIXTH HORSE-POWER LUNDELL FAN MOTOR, MANUFACTURED BY THE INTERIOR CONDUIT & INSULATION COMPANY, NEW YORK.

The motor assumes wonderfully small dimensions for any given capacity, due to the fact that every cubic inch of space inside the spherical keeper is effectively utilized. It is also very light on account of a short magnetic circuit having smallest cross section, with comparatively few turns of wire in the magnetizing coil.

The type of armature adopted is claimed to be the very best, being a modern Pacinotti drum, proportioned with a view of maximum efficiency. In the design of the motor particular attention has been paid to the shape of pole pieces in relation to the reaction between armature and field magnet. Thus the motor has been rendered sparkless, and the point of commutation remains fixed between the limits of load and at reversal of rotation. The need for a special rocker-arm for supporting and adjusting the brushes is consequently obviated.

The brushes themselves are small carbon pencils, fitted in bayonet jointed holders, and held upon the commutator by a small spiral spring.

The new motors are furnished in five different styles, as shown by the illustrations. They are superbly finished in rich black japanning with red and gold striping. The one-twelfth horse-power motors are all fitted with ball bearings which require no oil, a most valuable consideration, and run at a maximum speed of 1,800 revolutions per minute, a minimum speed of 900 and a mean speed of 1,150 at 110 volts electromotive force, while the one sixth horse-power motors have a maximum speed of 1,800 revolutions, a minimum speed of 900 and a mean speed of 1,000 revolutions per minute.

The novelty of the design alone commends the motor at once, not only to electricians, but to laymen as well, and all who see it at work praise it highly.

INSULATION.

A PAPER READ AT THE ELEVENTH ANNUAL MEETING OF THE ASSOCIATION OF RAILWAY SUPERINTENDENTS OF TELEGRAPH, DENVER, JUNE 16, 1892,

BY THOMAS A. EDISON.

To telegraphy, the insulation of its circuits is so vital a matter, that at the risk of making history repeat itself, and of recounting an oft-told tale, a short paper on the subject may be tolerated.

As a class, gases are the best insulators; next liquids and solids last of all. The insulation of gases is so good that no determination appears yet to have been made of any leakage through them. If it were possible to make an experiment at or near the center of the earth, so as to be beyond the reach of gravitational force, an electrified body might be left for hours in a gas without any visible means of support, and observations then made to determine whether any loss of charge took place through surrounding gases. Under existing circumstances the loss of charge which always does take place on electrified bodies cannot readily be traced beyond that through the suspension or support that holds them. Even in moist air the loss of charge has not yet been brought home to the aqueous vapor. Professor Boys exhibited before the Physical Society of London, in April, 1889, a pair of electrified gold leaves, suspended in moist air by a short hook of quartz. The loss of charge appeared to be about 25 per cent. in five hours. A glass hook under the same conditions would have allowed the charge to disappear, it was said, within one minute.

If any perfectly insulating solid could be found, telegraphists would soon discover any surface leakage from their wires through the air, for the surface of a No. 8 B. and S. wire is 224 square feet, or 20.8 square metres per mile.

The loss of charge, which takes place convectively into the air over any sharp point in an electrified body, is a phenomenon of a different nature. There, the layer of atmosphere over the point is continually being torn by the magnitude of the forces brought locally to bear upon it, and the particles of moving air carry away the charge.

Some liquids have also a very high insulation, notably most mineral oils. Animal and vegetable oils are by no means so good, or, at least, there is greater difficulty in obtaining them in a highly insulating condition. Water, contrary to prevailing notions, is quite an insulator. In the purest distilled water, resistance as high as seven megohms per cubic centimetre have been recorded, that is to say, a block, one centimetre cube of water pressed between two opposite conducting planes, as electrodes, would offer a resistance of seven megohms; but the least trace of impurity brings the resistance down.

Ice at 12 degrees C. has been measured at 2,340 megohms per cubic centimetre. There are two conditions of surface upon which bare wires, miles in length, laid on the ground have been worked telegraphically, one over the dry desert sands of Africa, the other over dry ice in the far north. Sea

water has a resistance of about 30 ohms per cubic centimetre at five degrees C.

It would appear probable that liquids cannot conduct without electrolytic decomposition. A microscope will show that one microampere decomposes the drop of water it traverses.

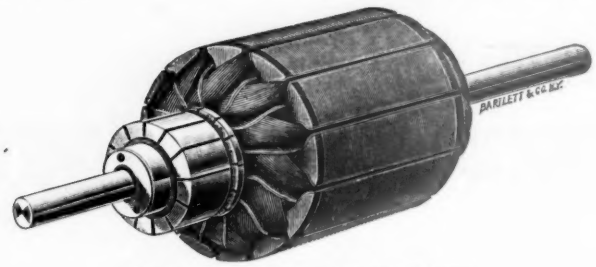

FIG. 2.—ARMATURE OF LUNDELL MOTOR.

One of the most important and promising modern theories of chemistry is based upon the assumption, in accordance with a considerable array of facts, that solutions only conduct by the transfer of atoms or ions to the electrodes, each carrying an electric charge, and the conductivity of a liquid measures on this hypothesis the number of uncombined or dissociated ions permeating its mass. These free ions are the porters carrying the charge, and the conductivity of the liquid depends upon the number available and the speed with which they can migrate.

Liquids, too, have, as a class, the quality of elastic insulation to high tensions, which is an important feature to the electrical engineer. Air for the first few centimetres will break and allow a spark discharge to occur when the pressure reaches from 10,000 to 50,000 volts per centimetre (25,400 to 127,000 volts per inch) according to the shape and condition of the electrodes, but rosin oil is said to stand about 75 times the pressure of air per centimetre without disrupting.

The following is a list of actually observed resistance in commercial samples of well known insulating substances. The results are given in megohms per cubic centimetre at or near 18 C.:

Paraffine wax, 110,000,000 megohms; heavy paraffine oil, 8,000,000 megohms; olive oil, 1,000,000 megohms; lard oil, 350,000 megohms; creosote, 5.4 megohms; stearic acid, 350,000,000 megohms; sperm oil, 0.077 megohm; benzine, 14,400,000 megohms; balsam copabia, 211,000 megohms; benzole, 1.320 megohms; oil of wood tar, 1,670,000,000 megohms; crude ozokerite, 450,000,000 megohms.

All transparent solids are insulators, but, of course, the opposite statement is not true that all opaque solids are good conductors. There is now good evidence for believing that the process by which light is propagated, the mechanism by which it is transmitted through space, is purely electromagnetic, and the magnetic vibrations passing through a conductor would generate electrical currents and be absorbed in the substance as heat, that is to say, it would be opaque to the light, failing to transmit the energy.

The difficulty with solids is not so much to find insulators, for the great majority of solid substances freed from moisture are poor conductors, but to find an insulation of suitable mechanical qualities. Glass, porcelain and mica seem to be almost the only practically available insulators that will support considerable stresses, and these for many structural purposes are far weaker than is desired. In American telegraphy, glass is almost the universal insulator, but in Europe, particularly in the South and West, the atmosphere is so much more humid, and glass so hygroscopic, that no circuit of any length could be operated with glass insulators except in dry weather. Porcelain or vitrified stoneware insulators are used instead and in quite a variety of forms. Practically speaking, the insulation of a line is never that of the material forming the insulators, but always that of their surfaces, and the films of dust and moisture that may have become encrusted thereon. The most perfect insulators are those which have underneath the hood, a cup filled with oil, in such a manner that the current leaking from the wire to the ground has to pass over the oil, or else through the substance of the insulator itself. These insulators are certainly more expensive, and require to be refilled with oil at intervals, but they will defy weather and keep the insulation nearly as high in fog as in sunshine.

When a long leaky wire is opened at the distant end, and tested for insulation, the insulation per mile always appears to be somewhat more than it is for any actual mile, since the more distant portions of the line are tested with a reduced pressure owing to the leakage over the nearer portion. When the wire is grounded at the far end, and its conductor resistance measured, the leakage will, on the other hand, make the apparent resistance per mile too low. But, if the conductor resistance is reduced in a given ratio, say as 100 to 95, the insulation will be overindicated in the exact inverse ratio of 95 to 100, provided that the insulation of the line is uniform. So that, if a wire's conductor resistance and its temperature of observation is known to be 10 ohms per mile, but appears by leakage over the whole length to be 9 ohms, then if the insulation per mile apparently measures 400,000 ohms, it will be really 360,000, and each mile taken separately might be expected to measure 360,000. As is well known, telegraph lines work better up to a certain point if the insulation is rather low. A wire has to be emptied of its charge between the impulses of the key sufficiently far to keep the relays from sticking. If the insulation is perfect, this quantity has to be cleared through the ends of the ground, but if the line leaks it can escape more readily at all points.

The longer the line, the more essential good insulation necessarily becomes. The insulators are perhaps never more carefully tested than those intended for the long circuits on the Asiatic plains. It was at one time customary to test each insulator before it went out, by taste. The insulator was immersed nearly to the rim, head downwards in water, and a battery of 100 cells was connected with one pole to the water and the other to the insulator stalk through a particular kind of key. The operator first rested his moistened finger on this key and then applied his tongue to it. If he tasted no current, the insulator was passed out as satisfactory. The test was sensitive and expeditious, and saved the care and handling of a galvanometer.

The insulation of a wire is a definite term and stands for a definite property so long as it is not necessary to measure it very accurately. There is usually no difficulty in finding the insulation of any overhead wire within five per cent., at any one time, and two observers measuring the line from the same end with different instruments would generally agree in their results to that limit, but as higher degrees of accuracy are attempted (a condition that fortunately does not practically occur), the difficulty of obtaining concordant results may increase rapidly. A resistance coil of wire at a uniform temperature can have its resistance measured to within one-fiftieth of one per cent. if necessary, but a leakage resistance is essentially liable to variation. The atmospheric conditions may be altering, or there may be polarization, or inductive disturbances from neighboring wires, or a combination of conditions that may set close measurement at defiance. It is generally advisable to employ galvanometers for this purpose that, even if sensitive, are slow of movement and deadbeat. The only instances in which accurate measurements of insulation are possible and necessary, are in connection with subterranean or sub-aqueous wires. Jute and paper, dry or saturated with compound, are rapidly coming into use for subterranean wires sheathed in lead, while for long cables under water, india-rubber and gutta-percha are invariably employed. With conductors highly insulated by these methods, the insulation can be measured much more closely, and is definite for a given temperature of the core, but, even in this case, the current that will flow from a battery into the wire, freed at the distant end, is not all leakage. A considerable portion may be stored up in the insulating substance, and be returned from the wire to ground after the battery has been removed. This "polarization" is particularly noticeable with gutta-percha and india-rubber covered wires, and their insulation may be, apparently, 50 per cent. greater after three minutes of charging than at the end of the first minute. In specifications it is usual to call for a certain insulation per mile at 75 degrees C., and after a definite interval of charge.

The insulation obtained from a given thickness of covering depends on the diameter of the wire as well as on the quality of the cover, for a large wire supplies a larger leaking surface. Also, if an insulating coating of a certain thickness produces an insulation of 100 megohms per mile, doubling that thickness will not double the insulation because the leakage will take place with greater relative facility through the greater surface of the second coat. The exact increase of insulation will depend upon the diameters of first coating and wire.

When a wire is well and homogeneously insulated, its insulation resistance at a given duration of charge or period of electrification will appear to be the same with different battery powers or voltages applied, but if, on the contrary, it contains any small faults or defects, it will generally show less insulation with increasing testing pressures. This often forms a criterion as to the reliable insulation of a long cable. The insulation in an ocean cable under the pressure of great depth and near the temperature of melting ice that deep oceans approach, might be 15,000 megohms per nautical mile at the fifth minute. With a small incipient fault the insulation might still reach 3,000 megohms per mile and seem excellent, but it is probable that, when tested with five cells and with 50 cells, the insulation resistance in the latter case would not appear so high. It would also probably be different with the zinc or copper pole to line.

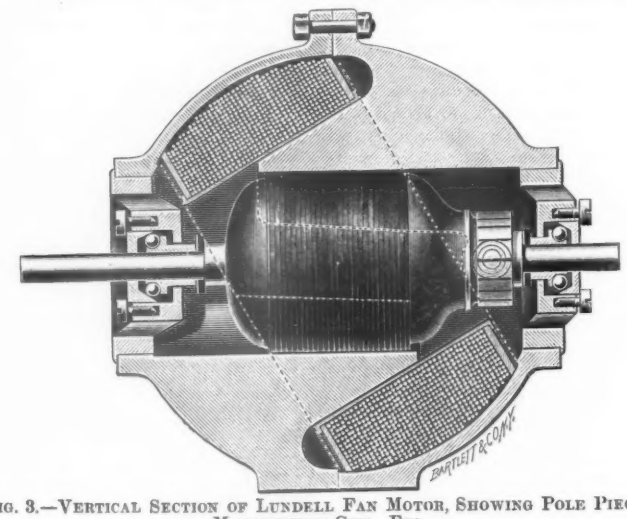

FIG. 3.—VERTICAL SECTION OF LUNDELL FAN MOTOR, SHOWING POLE PIECES, MAGNETIZING COIL, ETC.

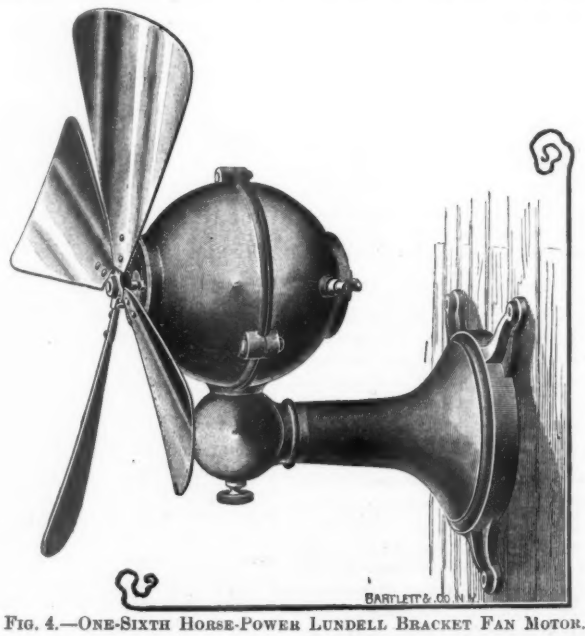

FIG. 4.—ONE-SIXTH HORSE-POWER LUNDELL BRACKET FAN MOTOR.

The only value that can attach to a high measured insulation is the assurance it conveys that no flaws exist in its covering or supports and will, therefore, remain in good signaling order unless disturbed. In fact, a very high insulation, as we have seen, actually tends to retard signaling. Mechanical security from the loss of insulation is the great desideratum rather than a very high degree of insulation itself.

American Chemical Society.

The fifth general meeting of the American Chemical Society will be held at Rochester, N. Y., August 16, 1892. Members are requested to send early notice of papers to be presented at the meeting to A. A. Breneman, chairman of committee of arrangements, 97 Water street, New York city.

Electricity and the Law.

Where an electric light and power company owned land on which was a building and machinery for generating electricity, and had a franchise from a city to use its streets for the erection of poles on which to stretch wires and suspend lamps to furnish light for the people of the city, and poles were planted in the streets of the city, and wires and lamps were placed thereon, and all were connected by the electric light wires with the machinery and premises of the company, the Supreme Court of Kansas held (Badger Lumber Company *vs.* Marion Water Supply, Electric Light and Power Company) that the poles and wires were an appurtenance of the premises of the company, and that a person from whom they were purchased was entitled to a lien upon the same for the poles furnished.

The question was recently raised in Pennsylvania whether the right to construct a railway upon which cars are to be moved by horse-power includes the right to operate a railway by means of electricity. Judge Simonton, in the case in which the question was raised, granted an injunction preventing the Harrisburg Street Railway Company from constructing an electric line, holding that it had no right to use other than horse-power. He said: "There is certainly room for doubt whether the right to construct a railway upon which cars are to be moved by horse-power includes the right to operate a railway by means of electricity. It certainly would not include the right to operate by means of steam; but we think there is greater difference between horse-power and that of electricity than between the latter and that of steam. If the first includes the second, how are we to say that the second does not include the third, and if by construction we enlarge the power beyond that already conferred, where are we to draw the line?"—*Bradstreet's.*

Since June 1 a telephone line between Paris and Antwerp has been open to the public. A charge of half a crown is made for five minutes' conversation.

THE LAMP FILAMENT PATENT.

DECIDED IN FAVOR OF THE DEFENDANT, THE EDISON LAMP COMPANY.

At Trenton, N. J., on June 20, Judge Acheson handed down a decision in the case of the United States Electric Lighting Company *vs.* the Edison Lamp Company, which was a controversy over a hydro-carbon treatment of incandescent lamp filaments. The ELECTRICAL REVIEW of June 25, contained exclusive mention of the decision in this case. The document is presented in full herewith:

This suit is brought for the infringement of Letters Patent of the United States, No. 306,030, dated October 21, 1884, granted to Edward Weston, upon an application filed May 27, 1881, for an improvement in the process of manufacturing carbon conductors for incandescent electric lamps. The nature of the invention is sufficiently indicated by the claim, which is as follows:

"The improvement in the art of making carbon conductors for incandescent lamps, which consists in first forming a carbon core or base, and then building up said core with carbon obtained and deposited upon the same by and during the operation of electrically heating said core, while surrounded by or saturated with a carbonaceous substance substantially as hereinbefore set forth."

A number of defences to the suit have been interposed; but it seems to me to be necessary to consider only two of them, namely, first, the prior Letters Patent of the United States, No. 211,262, for the same invention, dated January 7, 1879, granted to William E. Sawyer and Albon Man, upon an application filed October 15, 1878; and second, the alleged public use of the invention by Sawyer and Man and those acting under them for more than two years before Weston's application for a patent.

That the invention set forth in Weston's specification and claim was fully disclosed by Sawyer and Man in their above recited earlier patent, is clear. It is shown also beyond contestation that Sawyer and Man made and perfected the invention, and actually reduced it to practical use in the month of March, 1878. Nevertheless, the plaintiff, the assignee of Weston, asserts priority of invention and right for Weston over Sawyer and Man; and it appears that in an interference proceeding in the Patent Office between these inventors, the decision of the office was in favor of Weston upon the question of priority. The proofs in that proceeding, which were taken in the year 1882, have been brought into this case by stipulation, and some other additional evidence upon that question has been introduced.

Weston testifies that he commenced his experiments in treating carbons by electrically heating them in a carbon liquid at Newark, New Jersey, "some little time prior to the Centennial in 1876, he cannot, however, fix the precise date" at his laboratory No. 194 Eighth avenue, and continued these experiments there, and afterwards, with some described modifications, at 228 Plane street, whither he removed "in the early part of 1877, about the month of April, 1877"; that "soon after" his removal to Plane street, "about the month of June or July, 1877, it may have been a little later, or possibly a little earlier, but was not very far from the date named," he transferred part of his apparatus in order to have the advantage of steam power, to the basement of the shop of the Weston Dynamo Electric Machine Company, at 284 Washington street. This building had originally been a Jewish synagogue, and hence is designated by the witnesses as "the church." Mr. Weston states that with his facilities in the "basement of the church" he there succeeded in obtaining carbons very much superior to anything he had before obtained. Upon that subject he says: "They are extremely hard, in fact so hard that they suggested to my mind the possibility of preparing in this way black diamonds. They were so hard and dense that I took particular pains to show them to Mr. Edward E. Quimby, and I handed him a file to test them with, and he also endeavored to scratch the glass in one of the windows in the rear end basement of the factory. Mr. Quimby was so much struck by the metallic appearance of the carbon, its density and hardness, that he asked me to give him some samples, which I did at that time, namely, about the middle of the year 1877. From that time I saw that I had overcome all trouble relating to the preparation of carbons for incandescent lamps." Mr. Weston then describes the process which he used most and preferred at that time. Being asked upon his examination in chief to state generally to what extent and under what circumstances he used this process of preparing carbons subsequently to the year 1877, he answered: "I have used the process more or less from that time up the present time (*i. e.* March, 1882) whenever I did any work on incandescent electric lighting, and I have done a great deal in this direction. After perfecting the carbons, I still found there were numerous conditions to be met in order to secure a commercially successful incandescent electric lamp, and with this idea in view, I worked from time to time, as time and circumstances would permit, trying to overcome the other difficulties. During this time I used almost exclusively the carbons prepared by treating at a high temperature in the presence of hydro-carbon gas or oil."

Being asked upon his cross-examination how many carbons he treated after he commenced work in the basement of the church, Mr. Weston answered: "Quite a number. I kept no record of the quantity treated. There were several dozens." In response to the inquiry how long he continued to treat carbons in the basement of the church, he stated: "Until the removal of my laboratory to a separate building next door to the factory. I cannot fix the date without reference to the books of the company, as I took no pains to refresh my memory in regard to this matter. My impression is, however, that it was in the early part of the following year." He added that he could and would ascertain the exact date of the removal of his laboratory from the basement of the church to the building next door, for the company had provided him the room in the building next door "and engaged to pay the rent." Afterwards, when his examination was resumed, Mr. Weston stated, "I cannot fix the precise date when I moved

FIG. 5.—ONE-SIXTH HORSE-POWER LUNDELL SUSPENDED FAN MOTOR.

into the laboratory next door to the church, but the first entry I can find on the books in regard to rent paid is on the first day of October, 1878."

Edward E. Quimby (a solicitor of patents), after fixing his first acquaintance with Mr. Weston as having occurred in May, 1877, testifies thus: "Mr. Weston did describe to me his discovery that a deposit of carbon was formed upon a carbon pencil, maintained in a condition of incandescence by the passage of an electric current through it while it was surrounded by a hydro-carbon atmosphere. He brought to my office and gave me samples of such deposits, which were in small particles, but of extraordinary hardness. This communication was made to me by Mr. Weston, according to the best of my recollection, within six months of the date of my first acquaintance with him, while I was engaged in perfecting some of his older patents by reissuing them." Mr. Quimby then states that a day or two later he visited Mr. Weston's laboratory on Washington street, in the basement of the old church "and witnessed the operation of his method of obtaining such deposits;" and he describes the apparatus used and the operation. Upon his cross-examination, Mr. Quimby states that he has no memoranda in writing by which he can fix the date of this visit to Mr. Weston's laboratory, but says it "was during the early part of my acquaintance with him; it was within six months of the time of my first seeing him, and was before cold weather set in." He says, "Mr. Weston moved his laboratory into the adjoining building some time after the experiments to which I have referred, and after that removal my visits to his laboratory were more frequent than before. He states he has no recollection when that removal took place. Being asked if after the removal he saw any incandescent electric lamps in operation in Mr. Weston's laboratory, he answered: "I cannot say. My memory is wholly at fault in the matter." And being further asked, when, after the experiments he testified about, he first saw an incandescent electric lamp made by or for Mr. Weston having an

QUEEN'S PORTABLE TESTING KEY.

illuminating conductor of this treated carbon, Mr. Quimby answered, "It is impossible for me to say. I cannot recollect."

Levi Broadbent, who was a foreman in the employ of the Weston Dynamo Electric Machine Company from July, 1877, to September, 1879, testifies that upon one occasion when passing through Mr. Weston's laboratory he "saw him treating, or having carbons in a globe filled with oil and running a current of electricity through them." This, he says, occurred "between the month of July, 1877, and the first of January, 1878; I can't positively fix the date; it was between these points of time." He states that Weston subsequently spoke to him about the matter, "and said that the carbon that had been in the oil and the electricity run through it was very hard, and so that a file would not touch it."

Upon his cross-examination, Mr. Broadbent testifies thus:

Q. "How do you know that it was previous to January, 1878; by what circumstance do you fix on that date as being the date previous to which you saw Mr. Weston treating the carbon?"

A. "I know it by the circumstance that Mr. Weston's new laboratory was finished in December, 1877; it was in the laboratory I saw this."

Q. "Was it in the laboratory in the basement of the church?"

A. "Yes, sir; we used to call it the church; it was a church once."

Q. "And you saw Mr. Weston treat these carbons in that laboratory for the first time, as I understand you?"

A. "Yes, sir."

Q. "When did he move into that laboratory?"

A. "I couldn't place the date exactly, but it was just after it was finished. It was in December, 1877."

The substance of the testimony by which it is sought to anticipate Sawyer and Man has been above set forth. Is the evidence, under all the circumstances, sufficient to establish a complete invention by Weston prior to March, 1878? Leaving out of view the negative testimony of the defendant's witnesses who naturally would know something of Weston's doings, the plaintiff's own evidence impresses me as singularly vague. Did Weston's operations as described by himself and his witnesses amount to anything more than experiments? Could the invention here in question be derived from anything Quimby or Broadbent saw Weston do or learned from him, any more than it could have been deduced from the Despretz publication of 1849? Do the proofs convincingly show a perfected invention made by Weston in the summer of 1877, as alleged by him? Then, again, is there any reliable testimony as to the all important matter of time? Here the plaintiff's case rests altogether upon mere recollection, which is always unreliable as respects dates. The only date certainly fixed is October 1, 1878, when the rent was paid for the premises adjoining the basement of the "church" so called. But the book entry of that payment strongly suggests that the removal of Weston's laboratory from that basement to the building next door took place not in the early part of the year 1878, according to Weston's "impression," but late in that year; and that conclusion would shake the whole fabric of the plaintiff's case. In this connection the testimony of Broadbent quoted above deserves the most serious consideration, for that witness seems to testify that Weston did not go into the laboratory in the basement of the church until December, 1877.

How can Weston's assertion that from "about the middle of the year 1877" he saw that he had "overcome all trouble relating to the preparation of carbons for incandescent lamps" be satisfactorily reconciled with his subsequent conduct, his silence as to an invention then deemed so important and his supineness? His great delay in applying for a patent for this process is the more extraordinary when we discover from the proofs that in the years 1878 and 1879 he took out or applied for no less than 10 patents for various other inventions. Furthermore, it is a significant fact that when Weston eventually moved, on May 27, 1881, his application for a patent was made in the interest of the plaintiff company (which had become the owner of his inventions) after the plaintiff had failed in its negotiations to purchase the Sawyer and Man patent, or acquired a license under the same.

To overthrow the prior patent of Sawyer and Man which had issued so early as January 7, 1879, and was immediately followed by uncommon publicity, the proof of anticipation by Weston should be at least positive, unequivocal and convincing. *Cantrell v. Wallick*, 117 U. S. 689, 695; *Clark Thread Co. v. Willimantic Linen Co.*, 140 U. S., 481, 492. Taking the proofs as a whole, they fail to satisfy me that Weston's alleged invention preceded that of Sawyer and Man.

But whatever conclusion upon the question of priority may be adopted, at any rate, under the proofs, the defence of two years' prior public use of the invention before the application for the patent in suit rests upon impregnable ground. A public use does not depend upon the number of persons to whom the use is known, and it is enough if a single device embodying the invention is publicly used by even one person. *Egbert v. Lippman*, 104 U. S. 333. And a public use of the invention more than two years before the application for a patent, although without the consent of the inventor, invalidates the patent. *Andrews v. Hovey*, 123 U. S. 267, 274, and 124 U. S. 694.

In March, 1878, when Sawyer and Man made the invention here in controversy they were engaged in completing an incandescent electric lamp of their devising, which they perfected to their satisfaction and patented in June, 1878. Between March, 1878, and May, 1879, they and their assigns made a large number of these lamps, and continuously used therein for incandescent electric lighting at their workshop, in the city of New York, carbons prepared by the method described in and covered by their patent of January 7, 1879; and during that period they there exhibited both the actual treatment of the carbons by the patented method and the use thereof in their lamps to large numbers of persons, besides the workmen in their employ. Clearly this use of the invention, as shown by the proofs, was a public and practical use. It is here worthy of remark that the *Scientific American*, in its issue of March 8, 1879, published a clear description of the process of treating carbons as practiced by Sawyer and Man, and as set out in their patent.

Whatever experiments Sawyer and Man may have made after March, 1878, concerned their lamp, with a view of increasing its efficiency and commercial value, and did not relate to the carbon treatment itself, which was perfected in March, 1878, and required no subsequent test.

Now, it may be that the Sawyer and Man lamp did not prove the success the inventors supposed it to be, and that no perfect incandescent electric lamp was produced until the fall of 1880. But, still the Sawyer and Man lamp was actually operative and had some practical utility. That it was not a commercial success is not here a controlling consideration. The material fact is that the method invented and patented by Sawyer and Man for the treatment of carbons was put to successful practical use by them in their lamp. No doubt the commercial value of the invention depended much upon the production of a perfect incandescent electric lamp, but, nevertheless, the treatment of carbons by electrically heating them, while surrounded by or saturated with a carbon liquid was a distinct invention. It was an independent and valuable contribution to the general art of electric lighting. This, indeed, is the position of the plaintiff company, for it alleges that Weston made and perfected the invention as early as the summer of 1877, before a perfectly successful incandescent electric lamp had been devised by any one.

I have only to add that it is quite evident from the proofs that the issue of a patent to Weston was inadvertently made in disregard of the expressed views of the examiner of interference and the examiners in chief that Weston was precluded from the grant of a patent by reason of the statutory bar of two years' public use disclosed by the evidence in the interference proceedings in the Patent Office.

For the reasons above given, and without reference to other alleged defences, the bill of complaint must be dismissed.

Let a decree be drawn dismissing the bill, with costs.

Portable Testing Keys.

While practically all galvanometer and other electrical keys are portable in that they can be carried about, yet the type illustrated herewith, manufactured by Jas. W. Queen & Company, Philadelphia, is decidedly unique and very useful.

Every one who has occasion to make insulation tests away from a laboratory knows how essential it is to have apparatus that is reliable, and at the same time adapted to surrounding circumstances; that is, accuracy must be combined with portability.

A short circuit key or a contact key that can be thrust into one's pocket will commend itself for convenience to those engaged in outside work, and we are informed by Queen & Company that they can "fill the bill" with their new products. The keys are made of hard rubber, polished, with brass connections and platinum contacts, and the desired effect is produced by simple pressure of the hand.

As to "weights and measures," none are longer than five and a half inches, and they weigh not over five ounces each. Three forms are now made, viz., single contact, double contact and short circuit.

The Magnetic Permeability of Special Irons for Electrical Purposes.

READ AT THE GENERAL MEETING OF THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS, CHICAGO, JUNE 6-8, 1892, BY MILTON E. THOMPSON, PERCY H. KNIGHT AND GEORGE W. BACON.

During the last year or two there has been a marked change and improvement in the qualities of iron used in the construction of electrical machinery. It is now generally well understood that not only are the efficiencies of transformers, dynamos and motors increased by improving the quality of iron used, especially where this iron is subject to changes of magnetism and consequent loss by hysteresis, but also that the capacity of any given machine will be greatly increased by improving the quality of the iron. Thus, in the majority of dynamos, the capacity of the machine is limited largely by the heating of the armature, and the greater part of the heat developed in an armature is usually produced in the core. If the heat developed in the core can be reduced by improving the quality of iron used, enough extra current may be taken from the armature to balance this saving in the core. Again, in a dynamo or motor, the principal part of the weight of the machine is due to the field magnets. If the permeability of these field magnets can be doubled by improving the quality of the iron used for their construction, the weight of these magnets may be reduced in the same proportion. In many classes of dynamo machinery, as, for instance, railway motors and marine dynamos, this saving in weight and consequent increase in the capacity of a machine of given weight is of great importance. It has long been known that the magnetic value of wrought iron is several times as great as that of cast iron; but the readiness with which cast iron may be moulded to the desired shape for field magnets has kept it in favor for this purpose, in spite of its low permeability. A demand has arisen for a quality of iron which shall have high permeability and still possess the quality of being easily cast into the proper shapes for field magnets for dynamo machinery.

Many attempts have been made to improve the quality of cast iron, but for the most part with little or no success; and cast iron stands to-day as a metal having nearly the same magnetic value for any and all qualities, though some slight improvements have been effected by some makers, as will be seen later. Attempts have also been made to produce castings from wrought iron and lately with fairly good success. This is accomplished in general by melting down scrap wrought iron in crucibles, rendering it fluid by the addition of a small quantity of aluminium and pouring as with ordinary cast iron. A great many extra precautions have to be taken to insure sound castings, and as a rule the castings made from this "mitis metal," as it is usually called, are rough and somewhat difficult to work, on account of their toughness. These castings have shown themselves to be of very much higher permeability than cast iron, and have rapidly come into favor, especially in the construction of railway motors. Makers of steel castings have also been experimenting with a view to producing a metal suitable for field magnets of dynamo machinery. Some of them have been very successful in this undertaking, and steel castings for field magnets are to-day an undoubted success. Manufacturers of sheet iron have also been trying to keep up with their fellow workmen in this line, and not a little experimenting has been done with a view to the production of better qualities of sheet iron.

The writers have recently made, in the laboratory of Cornell University, quite a number of tests of samples of various special irons from different manufacturers throughout the country; it was believed that some of the results obtained would prove of interest to the general electrical fraternity. The method used for these tests was a modification of that used by Rowland, the samples being prepared in the form of rings, and wound with two sets of windings, a primary and a secondary. The magnetizing current was passed through the primary circuit and measured by means of a Weston ammeter. A ballistic galvanometer placed in the secondary circuit measured by its throw the magnetic induction due to any given change in the magnetizing current.

Two different plans were tried in taking the curves and found to give slightly different results. The first was the reversal method, in which the current was commenced at its maximum value, and its direction reversed several times by means of a reversing switch, in order to bring the magnetism up to its full value, the secondary circuit being open during this operation.

The secondary was then closed through the galvanometer, the current reversed and the induction measured by the throw. The current was then slightly reduced, reversed several times as before, and the induction again measured on reversing the current. In this way the magnetizing current was gradually reduced to zero, and from the data thus obtained, curves were plotted with magnetic lines per square centimeter for ordinates and magnetizing force for abcissæ. In the other method, which was used for taking most of the curves, and which gives results more nearly like those obtained by Hopkinson, and which are generally accepted as standards for wrought and for cast iron, the sample was first completely demagnetized. In some cases this was done by simply reversing the current through the primary and at the same time gradually reducing it to zero. By this method, however, no samples except those composed of wrought iron sheets were successfully demagnetized, which might suggest that the foucault currents, set up by the reversal of the magnetizing current, tended to keep up the magnetization. An alternating current of both high and low periodicity was also tried without success, and it was only by finally heating the samples to a cherry red heat and allowing them to cool in air, so as not to change materially their softness, that total demagnetization was obtained. The sample being demagnetized, a small current was passed through the primary and the induced magnetism measured by the throw of the galvanometer. The current was then slightly increased and the deflection of the galvanometer again noted. And so on up to the maximum magnetizing force, the current being gradually increased step by step. The current was then reduced step by step to zero, reversed and increased step by step to a maximum equal to that of the other direction. This descending and reversal curve was taken simply to serve as a check upon the demagnetization and upon the accuracy of the observations of the ascending curve, and only the latter was plotted. Curves obtained from the same sample by the reversal method and by the step by step method were found to differ from each other by eight or ten per cent. at maximum values, the curves by the reversal process reaching the higher values. The magnetization of field magnets of dynamo machinery would probably reach values higher than that given by either of these methods of testing, for the iron being subject to vibrations from the rotating parts of the machine, and being at the same time under a continuous magnetizing force, would no doubt reach as high magnetic values as could be obtained by any method of testing.

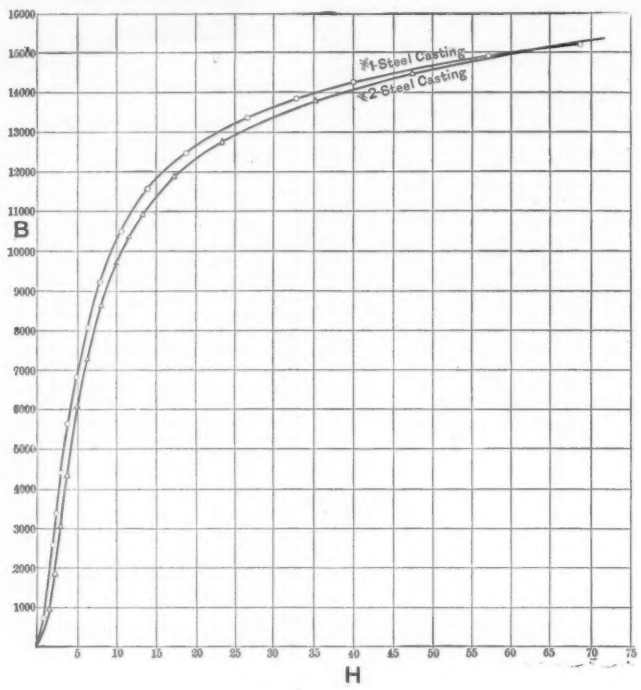

Fig. 1.—Permeability Curves.

The results obtained are embodied in the accompanying curves, which present the results of tests on samples of iron from a dozen different companies, in many cases a large number of samples of the same kind of metal having been tested. Referring to these curves, Plate I presents curves of two samples of steel castings from two different companies. The curves show both samples to be of very good quality, sample No. 1 being slightly the better of the two. Plate II shows two more curves of steel castings, No. 3 being an average curve of about a dozen different samples of steel castings furnished by one maker, and No. 4 being an average curve of several samples of steel castings furnished by another company.

The different samples represented in curve No. 3 did not differ very materially from one another, and there was but a very slight difference in the samples represented by curve No. 4. Curves Nos. 1, 2 and 3 were taken by the step by step method, while curve No. 4 was taken by the reversal method, which will account for the high value of this curve, in a measure, though it is very probable that the quality of the steel represented by No. 4 was somewhat better than that of the other samples. The curves on Plate III were all taken by the reversal method. Curve No. 5 is the average of two different samples of wrought iron castings from the same maker, the two samples, prepared at different times and from different pourings, showing almost identical qualities. The magnetic value of mitis metal, as shown by curve No. 5, differs very little from that of steel of good quality, as shown by curve No. 4. Curves Nos. 6 and 7 are from two samples of sheet steel of somewhat peculiar manufacture, inasmuch as they are said to contain no manganese, that element being perhaps the most objectionable impurity in mild steel, as far as its magnetic properties are concerned.

The two samples from which the curves were taken were made as an experiment, and by slightly different processes. They show excellent magnetic values, especially No. 6, and seem to indicate that wheel steel may some day come into extensive use for armature cores, etc. Curves Nos. 8, 9 and 10, of Plate IV, are from three different samples of sheet iron, used for armature cores and transformers by three well known electrical companies. Neither of these is up to the values given by Hopkinson for good wrought iron, but the difference in the method of taking the curves may account, in a measure, for their being lower. These curves were taken by the step by step method. Curves Nos. 11, 12 and 13, of Plate IV, are from three different samples of cast iron, used by three electrical companies for field magnets of dynamo machinery. Sample No. 11 is an ordinary quality of cast iron and differs from the values given by Hopkinson for cast iron by only an inappreciable quantity. No. 13 is rather peculiar, in that for high values of magnetizing force it is slightly better than ordinary cast iron, while for low values it is much poorer. Its magnetic properties are more like those of hard steel than of cast iron. No. 12 shows a metal whose magnetic value is from 10 to 15 per cent. higher than ordinary cast iron, the curve still keeping its same general shape. This sample would seem to indicate that there *is* such a thing as improvement in the magnetic qualities of cast iron. Curves Nos. 14 and 15 represent two different samples of wrought iron, used

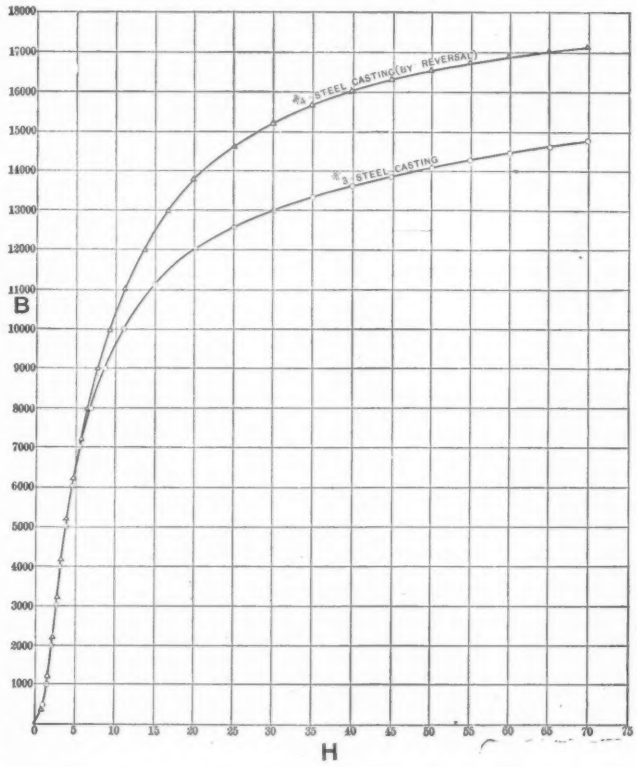

Fig. 2.—Permeability Curves.

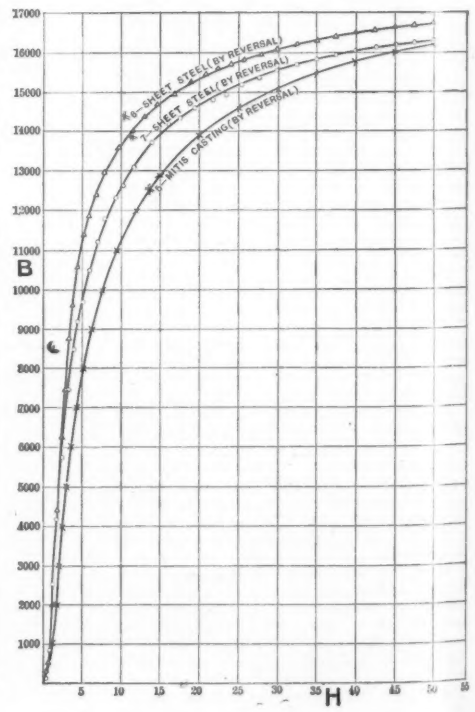

Fig. 3.—Permeability Curves.

by two electric companies for field magnets. These curves were taken by the reversal method, and indicate for the metals a value considerably below that of the best wrought iron.

Curves Nos. 16 and 17 are both from the same steel casting, and show the difference between the step by step method and the reversal method. Curve No. 16 is by reversal and No. 17 by step by step. Curves Nos. 18 and 19 are both from one sample of sheet iron, No. 18 being taken by the reversal method and No. 19 by the step by step. A similar difference in the two methods is indicated by these two curves. Plate VI is an attempt at a comparison of some of the more interesting of the curves mentioned above. Curve No. 20 is Hopkinson's curve for wrought iron. Curve No. 23 is an average curve for steel castings as made by four different companies. Curve No. 21 is a good quality of steel casting by the reversal method, and No. 22 is an average of mitis metal by the same method. Curve No. 24 is Hopkinson's curve for cast iron, and No. 25 is an extra quality of cast iron, which would seem to show that there is still a chance for the standard of cast iron to be raised. A comparison of curves Nos. 20 and 23 shows that the magnetic value of the average steel casting is only about eight per cent. below that of the best wrought iron, and from curve No. 21 we might infer that it would be perfectly safe to use for the best steel castings the magnetic values given by Hopkinson for wrought iron. Comparing curves No. 21 and 22 we see that there is practically very little difference in the magnetic values of steel castings of the best quality and mitis castings, and there seems to be no good reason for believing that the former cannot be made of quite as good quality as the latter.

Comparing both of these metals with curve No. 24, their magnetic values are so far superior to that of cast iron, that it seems quite certain that only the cost of production can stand in the way of their rapid and almost universal introduction for field magnets of dynamos and motors. When we consider that the cost of steel rails is but little different from that of cast iron, it seems reasonable, to suppose, that when the art of making steel castings comes to be better known and more fully understood, and better facilities are provided for their manufacture, such castings can be produced at a cost but little in excess of that of cast iron. Considering, then, the great superiority of cast steel over cast iron for electrical purposes, it seems safe to predict that the day is not far distant when steel castings will almost entirely replace cast iron in the construction of dynamo machinery, and the improvement in such machinery resulting from this change will be, perhaps, one of the greatest steps that has ever marked the progress of the electrical industry.

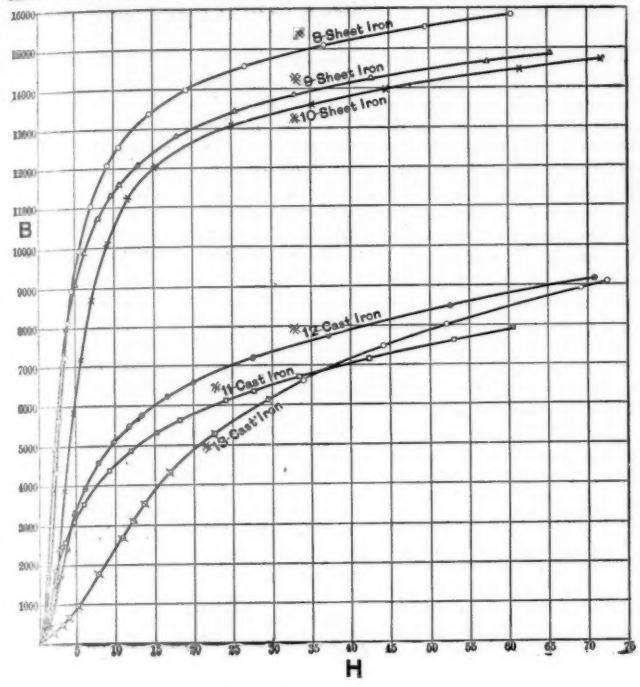

FIG. 4.—PERMEABILITY CURVES.

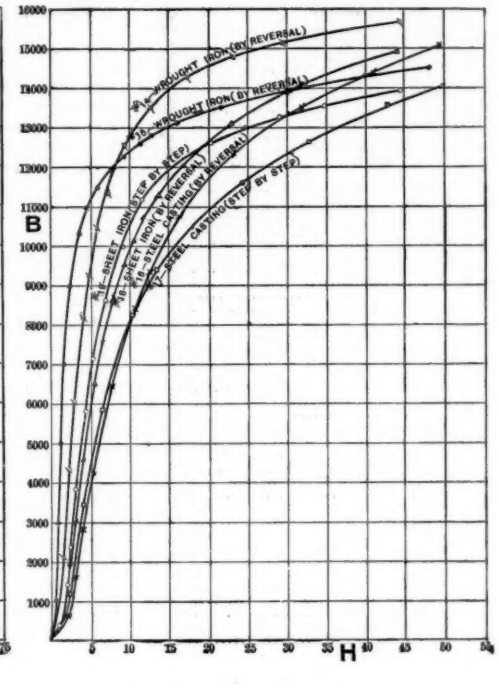

FIG. 5.—PERMEABILITY CURVES.

Residents of Fifth avenue have petitioned the New York Board of Electrical Control for arc lights on that aristocratic thoroughfare. Mayor Grant says that when the Board of Electrical Control proposed to build a subway on Fifth avenue, above Forty-second street, two years ago, the owners of property objected to having the avenue torn up, and therefore the work was not done.

Analyses of Glass Used in the Manufacture of Incandescent Electric Lamps.

BY DURAND WOODMAN, PH.D., IN "JOURNAL OF THE AMERICAN CHEMICAL SOCIETY."

In the manufacture of incandescent lamps there is a certain percentage of loss due to what may be termed spontaneous breakage; lamps, apparently well made, cracking at some part without having been subjected to any shock or blow.

A reasonable amount of loss in this way is unavoidable, from one cause or another, but when a certain limit is exceeded some special cause is suspected, as carelessness in the glass blowing department, want of sufficient annealing, and the like.

The difficulty often passes by during the efforts to control it, without any satisfactory explanation either of the trouble or the cause of its cessation.

The lamp bulbs may crack (*a*) where the platinum wires are sealed in, or (*b*) where the "stem" carrying the wires and carbon filament is joined to the bulb proper, or occasionally (*c*) where the exhausting tube is sealed on at the apex of the bulb.

In addition to the internal strains existing in any such glass work, the lamp bulb, when finished, is subjected externally to the full atmospheric pressure and to sudden heat strains from the instantaneous turning on of current, as occurs in perhaps a majority of lamps in use.

This combination of strains being considered, it is evident that differences in the glass used for the bulb and stem, and consequent differences of coefficients of expansion which, in ordinary glass work would not be of importance, will become manifest here.

Glass blowers know that similar grades of glass should be used together, but they are able to work up grades of glass differing in composition more than is permissible in incandescent lamps.

I have had an opportunity to make some analyses of the glass used at a time when the percentage of spontaneous breakage was abnormally large, and when every care in making up the lamps, annealing, etc., was unavailing.

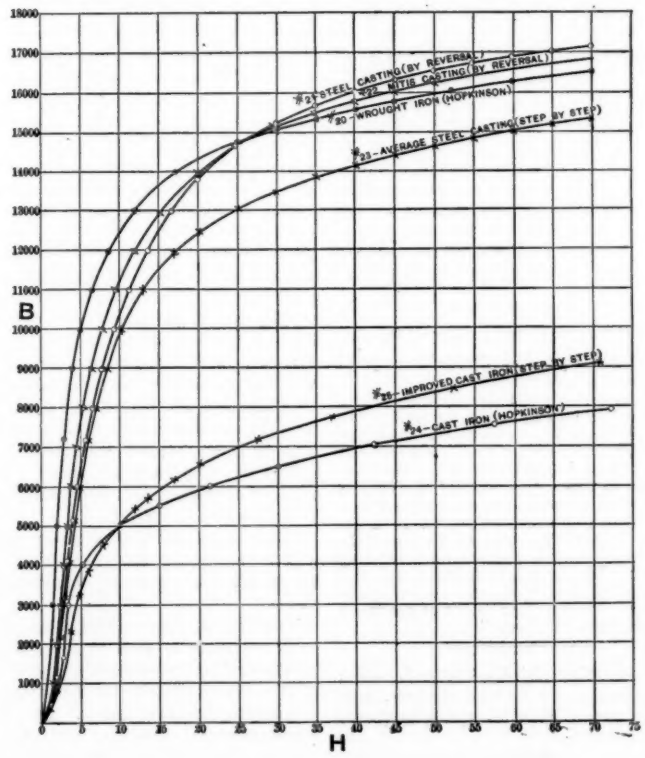

FIG. 6.—PERMEABILITY CURVES.

ANALYSIS OF GLASS ROD, TUBE AND LAMP BULB.

	Rod, 108.	Tube, 109.	Lamp Bulb, 112.
K_2O	1.38	4.20	2.32
Na_2O	15.06	9.05	14.50
CaO	2.15	—	6.40
MgO	0.70	—	0.93
MnO		trace.	trace.
Fe_2O_3 / Al_2O_3	1.02	1.65	1.45
PbO	16.81	19.83	1.39
SiO_2	63.44	65.16	72.85
Cr_2O_3	trace.	trace.	trace.
	100.56	99.89	99.34

These results explained the trouble from breakage in lamps made up from these grades of glass.

During the investigation, samples of glass of lamps by several different makers were analyzed; one of them, an English lamp, gave the following figures:

ANALYSES OF BULB AND STEM OF ENGLISH INCANDESCENT LAMP.

	Bulb, 115.	Stem, 116.
K_2O	5.20	6.14
Na_2O	9.20	8.10
CaO	5.41	5.05
MgO	—	trace.
Fe_2O_3 / Al_2O_3	—	1.10
PbO	2.90	10.68
SiO_2	73.10	68.24
	99.51	99.31

This bulb was a very brilliant clear glass. While nothing is known as to the percentage of breakage in the manufacture of these lamps, it is evident that no special effort has been made to use the same glass in both parts of the lamp. Another lamp (of American manufacture) was examined and found to be of the same glass throughout, as shown below:

	Bulb, 113.	Stem, 114.
K_2O	7.17	6.91
Na_2O	6.43	5.89
Al_2O_3	0.39	1.98
PbO	18.70	17.14
SiO_2	69.22	65.80
CaO	0.45	1.25
MnO / MgO / Fe_2O_3	traces.	traces.
	99.36	98.97

It should be said here that no proof has been obtained as to the possibility that some glasses of different composition may have similar coefficients of expansion, certain constituents compensating each other, but as it is a simple matter to obtain glass of practically the same composition for all parts of a lamp or any other complex glass work, problems connected with the coefficiency of expansion need not necessarily be taken into consideration.

The Motor-Man.

BY SHANDY MAGUIRE IN "LOCOMOTIVE ENGINEERING JOURNAL."

I would like to sing in a pleasing strain,
Yet, I fear I'll end in a sad refrain;
For the subtle forces of nature now
Are employing many a thoughtful brow,
In the field of progress, day and night,
To gather them in and hold them tight,
Till steam shall yield to the lightning plan,
And the engineer to the motor-man.

Let the sceptics scoff on every hand,
Let them doubt when they cannot understand;
But the mighty forces of steam must yield
To a mightier force, now scarce concealed
From the public view, but the gauzy veil
May be soon pulled off, and upon the rail
There will come a change in time's briefest span,
When we all must bow to the motor-man.

When Galileo preached his creed,
But few of his listners did him heed;
When Watts saw the lift of the kettle's lid,
He knew underneath there were forces hid;
When Fulton first launched his tiny boat,
Who'd dream of the palaces now afloat?
And when Morse his wires o'er the house-topsran,
Who'd think of the coming motor-man?

Alas, alas! for the engineers,
How their bones will bleach in a few more years
In the boneyards over the country wide,
Where we'll all be thrown, bereft of pride.
We may then sit down, and our cuds can chew,
Telling stories of days when we filled the view
Of the public eye, when we led the van,
Ere we heard a word of the motor-man.

What a mass of song in my simple way
I have chorused up for many a day!
How I tickled the ribs of the engineers,
And won pleasing smiles from their comely dears,
As I sung the joys of our railway life,
And I pictured pains of our daily strife,
As we forward marched in the labor van,
But I cannot sing for the motor-man.

I am now too old to begin anew,
I shall end my days with the engine's crew;
For the dynamos and the Leyden jars
I no more could catch than the distant stars.
In the cabs we reigned with a swing supreme
In the glorious days of the age of steam;
We must march in a ghostly caravan
When we're crowded out by the motor-man.

In London an incandescent lamp sheds its pleasing rays from the top of a barber pole. Electrical engineers are thus told where they can find an electrical barber of skill and enterprise.

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CHARLES W. PRICE.

ASSOCIATE EDITORS:
STEPHEN L. COLES.
ROBERT H. READ.

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Those who have not enjoyed the luxury of an electric fan during these hot days have missed a great deal. The great variety of fans offered makes selection easy. They are now made to set on a desk, suspend from the ceiling, in a bracket form, and of a revolving type. If a man were to surround himself with a series of fans running at full speed, the chances are that he would quickly become a good specimen of that curious phenomenon, *homus frappé*, which is Bostonese.

These remarks, in comparison of the electric light and gas, are made by our London contemporary, *Industries:*

"It is frequently urged that the high price of coal in any locality militates against the introduction of the electric light. As a matter of fact, it is the other way. Where coals are dear electric light cannot be cheap, but gas must be dear. The cost of the coal is only a small item in a central station, but it is a much more serious matter in a gas works. The dearer coal is, therefore, the more chance electric light has of competing with gas. We say competing with gas, but so far electric light is, of course, much dearer than gas. The real competitor of gas is not electricity, but petroleum."

In an interview with Mr. George J. Gould, the elder son of the railroad magnate, published in *Once a Week*, Mr. Gould is quoted in part as follows:

"We can do without the lost arts. We have new-found arts that are superior. There are a thousand years of progress in the electrical discoveries alone, and greater wonders are still to be disclosed. If steam locomotives are not entirely dispensed with I shall be greatly surprised."

These are remarkable words from the well-informed son of a remarkable man. It is certainly encouraging to the faithful ones in the electrical art to hear a man so intimately connected with great railroad interests express himself in such hopeful language.

PLEASE GIVE YOUR POST OFFICE ADDRESS.

The REVIEW is in receipt of a great many requests for sample copies, as well as orders from new subscribers, and in several cases recently both orders and requests have not included the post office address of the writer. We have several before us at the present time. We trust if this note should be seen by any of these would-be subscribers that they will write us again and be careful to give post office address in full.

TO THE SCOLDED ONE.

We have been a silent but interested witness of the scolding which our esteemed contemporary, the *Electrical World*, has delivered to one of the youngest aspirants for attention in the field of electrical journalism. As we are a thorough believer in fair play, one at a time, and as the subject of the scolding is none too strong, we have waited until now to make a remark or two.

One or two editorials in our esteemed contemporary called forth from the scolded one an apology which wound up in a diminuendo of extreme meekness. We presume that we shall draw forth the same meek excuse—that of having been imposed upon—from the scolded one, but perhaps we may not. The point in question is this: On page 192 of the May 4, 1892, number of the scolded journal is the fourth part of an article on "Electricity in the United States Navy." Fig. 15, illustrating this article, is a pen and ink drawing of a Gatling gun operated by a Crocker-Wheeler motor. The illustration is copied almost line for line from a pen and ink drawing of the Gatling gun which appeared on the first page of the ELECTRICAL REVIEW for October 4, 1890. The illustration in the REVIEW was the first one to appear of this new method of operating Gatling guns, and was mentioned at that time as a great triumph for the Crocker-Wheeler Motor Company. The only difference in the two illustrations is that our scolded contemporary has attempted to place the gun on what we suppose to be the bulwark of a vessel. Our gun was standing on the floor, as it really was when the sketch was made.

Considering the peculiar ideas of journalism which prevail in the office of our scolded contemporary, the above act may not be regarded by it as plagiarism.

THE SPANISH TELEGRAPH STRIKE.

The entire telegraph service of Spain is at a standstill, a general strike of operators having taken place last week. A novel feature of the strike is the plan adopted by the operators to render the service ineffective. The government suddenly found all communication by wire stopped, though the telegraph system was apparently in good working order. The operators did not leave their posts, but when asked to send messages they signaled as usual, and informed the officials that there was no response to their calls for the distant offices. This sort of passive resistance puzzled the officials. The Home Secretary in Madrid and Governors of the various provinces entered the offices escorted by gendarmes, and ordered the operators to establish communication in their presence. The operators replied respectfully, after calling the offices as commanded, that they received no answer, and, therefore, could not send the messages offered.

Business on the Bourse was paralyzed, and it was feared that seditious factions would seize the opportunity to create a revolution.

The first despatches which the government was able to send to the provincial governors were put through by the courtesy of the railway officials over the wires generally devoted to train orders. The railway operators were in sympathy with the strikers, and would not handle the government's messages; but some of the railway officials, who are practical telegraphers themselves, manned the wires and transmitted the messages.

The operators struck because their appeals for the redress of a number of long-standing grievances were disregarded. The immediate cause was the appointment of a postal officer of only three years' service to the office of director of the central office, in Madrid, over the heads of officers of 30 years' service. There is, as yet, no indication as to which side is likely to win in the contest

ANTIDOTE FOR ELECTRIC SHOCK.

Is it too much to expect that the medical fraternity will discover an efficacious antidote for electric shock? Many unusual features are presented in cases of this description, but nearly all possess in common the evidences of unconsciousness or apparently suspended animation. It has been the custom of electrical workmen to immediately lay on the ground a person who has been shocked. The idea seems to be that the body is a sort of storage battery, and that contact with the earth effects a ground and discharge. The more probable theory is that the fresh air revives the patient. In shocks of a serious or fatal nature, it has been shown that the blood corpuscles of the victim have undergone an organic change. Can this be corrected and the blood normalized by the injection of a drug? An amateur investigator is reported to have found that the insertion of aromatic spirits of ammonia into the body of a bird which had received a shock brought the animal back to life after all signs of animation had disappeared. This question affords an interesting field for experimentation and it might bring fame to the physician who will devote his time and talents to a scientific investigation of it.

THE RECENT DECISION ON THE WESTON LAMP FILAMENT PATENT.

The decision of Judge Acheson, handed down June 19, at Trenton, N. J., adverse to the Weston patent for the hydro-carbon treatment of incandescents in the case of the United States Electric Lighting Company *vs.* The Edison Lamp Company, settles an old controversy between Edward Weston and Sawyer and Man as to which was the prior inventor. Sawyer and Man obtained a patent, No. 211,262, for the process on January 7, 1879, and also a patent on the product, No. 229,335, dated June 29, 1880. The claim in the latter patent is "carbon consolidated and purified by electrically treating it, in combination with a carbonaceous substance, for the production of electric burners."

Edward Weston applied for his patent on May 27, 1881, claiming the process, and his application was put into interference with Sawyer and Man's process patent and the Commissioner of Patents decided the question of priority in favor of Weston and granted his patent, No. 306,930, on October 21, 1884. The Weston patent belonged to the United States Company and the Sawyer and Man patents to the Consolidated Electric Light Company. In 1885 the Consolidated Company brought suit against the Edison Electric Light Company upon the Sawyer and Man process patent, and testimony was taken in that suit in 1886, which showed that the Edison Lamp Company had made use of the process to a limited extent. This suit is still pending. The Westinghouse Electric Company having acquired control of the Consolidated and United States companies, the titles to the rival hydro-carbon patents came under its control, and as it was desirable to ascertain by judicial determination which patent was the valid one, suit was brought in the name of the United States Electric Lighting Company *vs.* the Edison Lamp Company, in New Jersey, and the proof of infringement was the same as in the Consolidated Company's suit, the same evidence being stipulated from one case into the other.

The Edison Company, in the Consolidated suit, set up Weston as a defence against the Sawyer-Man patent, and in the United States Company's suit they set up Sawyer and Man as a defence against the Weston patent, and in the United States Company's suit the same testimony which was taken in the interference case in the Patent Office was used, it being stipulated into the suit. Judge Acheson reverses the Commissioner of Patents, and decides that Sawyer and Man, and not Weston, were the first inventors of the hydro-carbon process, so that the suit, while against the title which the Westinghouse Company received from Weston, is in favor of the title they received from Sawyer and Man. The Edison Company had little at stake in the matter, as the extent of their use of the process, as shown by the testimony, was very limited.

CORRESPONDENCE.

OUR LONDON LETTER.

The Effect of this Action of Our Legislators may be indefinitely deferred by the dissolution of Parliament, which is now imminent, but, meanwhile, we may congratulate ourselves on the generous spirit of concession shown by the postmaster-general, Sir J. Ferguson, in the recent discussion on the telegraph and telephone services, which he informs us are now to be regarded as one. The public demand for them he fully recognizes, and he promises to give them liberal support. Indeed, the extension of the service, as stated by the right honorable gentleman, is really surprising. In 10 years, 2,722 telegraph offices had been opened. For the last five years there were from 220 to 340 opened in a year. This year the number of additional offices opened would be more than 400.

The **Society of Arts** have awarded the Albert medal for the present year to Mr. Thomas Alva Edison, in recognition of the distinguished services rendered by him to the progress of electric lighting, telegraphy and the telephone. This is the second time in its history that this coveted prize has been carried off by an American. In 1884, it was given to Captain Eads, for his eminent services to science—principally his great engineering works at the mouth of the Mississippi. The medal was instituted in 1862, as a memorial of the Prince Consort, who had been for 18 years the president of the society; and it is awarded annually for distinguished merit in promoting arts, manufactures or commerce. It was first awarded to Sir Rowland Hill, and among the men of science who have since received it we find Faraday, Whitworth, Liebig, Lesseps, Bessemer, Siemens, Armstrong, Thompson, Joule, Hofmann and Helmholtz.

The **Board of Visitors of the Royal Observatory**, at Greenwich, made their annual visitation of that establishment on last Saturday, when the Astronomer Royal submitted a full and most interesting report. His observations of the sun during the past year have been very frequent and very satisfactory. Photographs of the great source of light were taken during that period 219 times; and the solar activity, as shown by the changes on its surface had remarkably increased. The question of the association of these sun spots, with the magnetic disturbances on our earth, becomes thus one of greater and more practical interest. It appeared, from the Greenwich Records since 1875, that most of the magnetic storms occurred when an exceptionally large spot was visible on the sun, near the center of the disc, or about the time of some great change in a sun spot, also that magnetic storms were generally characterized by a sudden, initial movement of the magnets, simultaneous in all parts of the earth. In connection with the magnetic department, attention was drawn to the fact that the passage of trains on the electric railway, four and one-half miles from the observatory, seriously disturbed the instruments.

The **Most Important Event** in the London electrical world since my last communication would seem to be the report issued by the joint select committee of the House of Lords and the House on the projected subways of London. Six schemes were submitted to the committee: The Great Northern and City Railway, the Central London Railway, the City and South London Railway, the Waterloo and City Railway, the Baker Street and Waterloo Railway, and the Hampstead, St. Pancras and Charing Cross Railway. The first is designed directly to provide for the immense and increasing traffic of the Great Northern lines. The others are intended to relieve the overcrowding of our metropolitan thoroughfares, and to afford more easy and abundant communication between the city and the suburbs. Not only are these routes approved, but the opinion is expressed that in the near future they will require to be extended and multiplied; and the evidence of the various eminent experts examined upon the occasion was conclusively in favor of the sufficiency of electricity as a motive power, and its peculiar adaptability for underground tubular railways, while the method of cable traction possesses a special utility in the case of steep gradient lines.

JOSEPH FFRENCH.

June 11, 1892.

OUR BOSTON LETTER.

The **Electrical Storm** throughout the New England States on the afternoon and evening of June 17 did a good deal of damage.

The **New England Telephone Company** has finished putting down a telephone cable across the Charles river between this city and East Boston.

The **W. S. Hill Electric Company**, this city, will remove its offices and salesrooms from 54 Devonshire street to its recently enlarged works, at 133 Oliver street, the latter part of present month.

Mr. G. R. Lean, formerly identified with various electrical interests in this city, including the Sun Electric Light and Bernstein Electrical Manufacturing Companies, has accepted a position as New England agent for the Heisler Electric Light Company.

Something New.—A 15 ampere open switch for small motor circuits, for which there has been a great demand for some time but no supply, is now being manufactured by the W. S. Hill Electric Company, of this city. Great credit is due this company for its far-sightedness and enterprise in studying and catering to the wants of the trade.

The Mutual District Messenger Company, this city, at its recent annual meeting declared a quarterly dividend of $1 a share and elected directors as follows: Fred. L. Ames, Samuel Carr, Thomas Roche, Thomas T. Eckert, Charles A. Tinker, George H. Campbell, T. L. Larish, Otis Kimball and Allen S. Weeks. Samuel Carr was re-elected president and A. S. Weeks treasurer.

Mr. Chas. E. Bibber, general manager of the Consolidated Electrical Manufacturing Company, this city, has been personally appointed the general sales agent for the Boston Incandescent Lamp Company. The company named was organized recently, and are now exclusively manufacturing an incandescent lamp said to possess considerable merit as regards efficiency, brilliancy and long life.

Mr. J. R. Lovejoy, for several years identified with the engineering department of the Thomson-Houston Electric Company, is to be married to Miss Mary E. Gould, a resident of Lebanon, N. H., on Thursday, June 23. The young couple will start on their bridal tour through some of the Western States immediately after the ceremony, and will return to Boston about July 10. Prosperity, good health and happiness attend them.

W. I. B.

June 25, 1892.

OUR CHICAGO LETTER.

Rheostats with the wire imbedded in enamel are now being developed at George Cutter's shop, and will be put on the market early in the fall.

George Cutter is developing a line of rheostats and motor starting boxes with the wire buried in enamel, thus making the device fireproof and very compact.

The Enterprise Electric Company report the sale of a large amount of Kerite insulated wire during the past week, having secured the contract for wiring the Potomac and Melrose flats on the South Side. They are also having a large call for Enterprise annunciators.

The Chicago Office of the "C. & C." Electric Motor Company, located at 201 Madison street, is having a great demand for their well-known fan motor, and report many sales recently. They are rapidly stocking up the large store which they occupy, and are now in a position to supply the trade promptly.

A Severe Electrical Storm visited Chicago Wednesday evening, which was confined principally to the southern portion of the city and caused much damage in the vicinity. The dome of the Fisheries Building at the World's Fair was struck by lightning, but the damage done was slight and the portion will be rebuilt at once.

R. J. Randolph, representing the Duplex Electric Company, Cory, Pa., reports Western business largely on the increase, and has been obliged to cancel orders on account of the rush at the factory being so great that it is impossible to supply the demand. They are increasing their capacity and will soon be in a position to extend their trade and fill all orders promptly.

The Illinois Electric Lamp Company will put on the market a new incandescent alternating lamp of any candle-power, also a new waterproof lamp for damp places, such as distilleries, breweries, mines, etc., by which only one contact has to be made direct with the wire, and no sockets used at all. Patents for this lamp have been applied for and allowed in the Patent Office

The Central Electric Company reports having sold during the past week 150,000 of assorted sizes of interior conduit, with elbows, junction boxes and couplings. The Central Electric Company are the general western agents for the Interior Conduit and Insulation Company, manufacturers of the tube, and carry a large stock of it on hand at all times, which enables them to fill orders promptly, and to meet the growing demand of the business.

The Okonite Company are to be congratulated upon the continuous success of their high grade wire, the sales for the past week amounting to upwards of 1,000,000 feet, through the hands of the Central Electric Company, their general western agents. One single order amounted to 225,000 feet, besides a constantly increasing demand among the regular customers. The large stock held by the Central, of all sizes of wires, coupled with the excellent quality of the product, is perhaps some reason for the favor with which the wire is regarded.

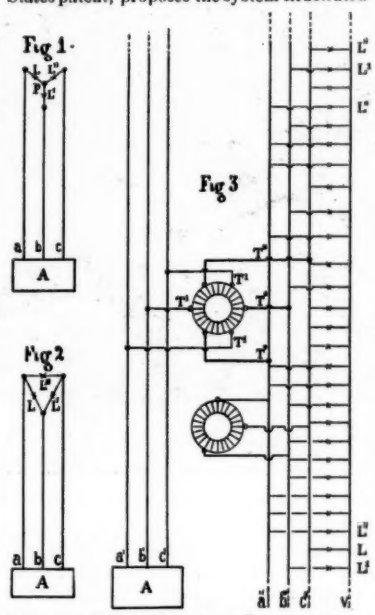
Chicago, June 25, 1892. M. J. B.

Distributing Rotary Currents.

In the ordinary systems of distribution of multiphase or polyphase alternating currents, the lamps are placed in parallel arc between two of the conductors, so that if it be a triphase system the lamps should be placed between the three supply conductors in groups of two.

According to Du Bois Reymond, this arrangement is open to the very serious objection that every separate wave of current transmitted through the three conductors distributes itself among the group of lamps in circuit, which are coupled in pairs in series; consequently, the average quantity of current in the three separate conductors is considerably greater than that in the individual lamps.

In order to avoid this objection and equalize the current through the several conductors, this gentleman, in a recent United States patent, proposes the system illustrated



REYMOND ROTARY CURRENT DISTRIBUTION.

in the accompanying diagram. In this diagram the three wires, a', b', c', are supplied by a triphase alternating current generator of high potential, and a reducing transformer, indicated at T^1, is used to furnish the supply currents of a local distributing plant.

The three low potential wires of the transformer are connected with their local distributing wires a'', b'', c'', and the lamps are placed in parallel arc between these wires and a fourth equalizing wire V, which permits the independence of the lamps to be maintained, both as regards the group in which they are included and the other groups fed by another pair of supply conductors.

It will thus be understood that N alternating currents of equal period amplitude and successive phase may be transmitted over N conductors to the place of consumption, and then transformed and distributed through N plus 1 conductors, and lamps such as require but a single alternating current included in circuit between any one of the N conductors and the 1 conductor, thus forming the best arrangement to divide the whole number of lamps by the whole number of currents transmitted, the quotient being the number of lamps to be placed in each group.

The patent is dated June 21, 1892, and assigned to Siemens & Halske, of Berlin.

The Magnetic Separator Company.

TO THE EDITOR OF ELECTRICAL REVIEW:

We notice in your issue of June 18, 1892, a communication from the International Ore Separating Company, by Harvey S. Chase, treasurer, denying the fact of a suit having been brought by the Magnetic Separator Company against the International Ore Separating Company for infringement of certain patents on ore separators, and process of separating ores, owned by the former company. Notwithstanding the denial, the fact remains that suit was brought by the Magnetic Separator Company in the United States Circuit of New Jersey, as stated in your issue of June 4; the complaint having been filed with the Court at Trenton, N. J., and the subpœna issued May 16, 1892.

The motive of the defendant company in denying the fact of the suit having been brought is not fully apparent to us. Some difficulty has been encountered by the United States Marshal in obtaining personal service, but in view of their threats, and for your protection, we have taken pains to secure a certified copy of the bill of complaint and subpœna from the files of the Court at Trenton, N. J., and herewith enclose the same to you.

Very truly yours,

THE MAGNETIC SEPARATOR CO.,

June 23. By C. M. BALL, Manager.

Letters from a Laboratory.

BY JULIAN A. MOSES.

The exact similarity in conditions attending the repetition of experiments is a great element of success. One should be very careful before coming to a conclusion that his premises are correct. A striking example of this was recently presented to my notice.

A dentist came into my laboratory the other day and said: "See here, I can't, for the life of me, understand what is the matter with me. All my patients complain that when I first put an instrument into their mouths it pains them fearfully. I've thought it all over, and have come to the conclusion that my instruments must be magnetized or bewitched, or I am. I've brought over some of them to have them examined. Just let me show you what I mean. Have you got a sensitive tooth?"

I pointed to a molar then under process of repair. He unwrapped some of his instruments, and selecting one, gently inserted it into my open mouth and touched the filling in my tooth. All I felt was the instrument touching the filling; I experienced no pain.

"Good heavens, man!" said he, "what nerve you have. What fortitude. What—"

"Nonsense," I exclaimed, "I didn't feel anything."

"Well," said he, "looking puzzled, "you are the first man that hasn't yelled when I touched his tooth since I moved into my new office. I can't understand it."

I told him I would come around to his office in the afternoon and see if I could find out what was the matter.

Later in the day I called to see him.

"Well, have you got it yet?" he asked, as he walked across the carpet and shook hands with me.

"I hadn't one second ago," I answered, "but I have now. Did you notice what happened when you shook hands with me?"

"Nothing but the electricity."

"That's just it. Every time you walk across the floor to your cabinet for an instrument, you get a small charge of electricity in your body, and naturally, as soon as you touch the sensitive tooth of the patient, the delicate nerve received the charge through your instrument—hence the pain. The reason why I felt no shock in the laboratory was simply because there was no carpet for you to rub your feet on before you touched my tooth."

Here we see that merely the want of a carpet on the floor altered entirely the conditions for a successful repetition of an experiment that had apparently no connection with the presence of a carpet.

I never will forget my chagrin and the time and labor lost on a determination that I once made of the magnetic dip for a certain locality when I returned home that night and gazed sorrowfully at the number of iron nails in my shoes. Never before did I so forcibly recognize the fact that horses and mules are not the only animals that have iron in their shoes. A pair of rubber-soled shoes next day helped me materially in making a correct determination.

Who knows how many valuable inventions have been lost to the world due to the failure of the experimentor in not having his conditions completely and accurately recorded?

Some one once said: "It is the unexpected that always happens."

This, of course, in a well planned and well conducted laboratory, is more likely to be the exception than the rule, and I believe a few points intended to prevent the happening of the unexpected will not be out of place.

All authorities recommend and advise a thorough and most exact account of all the minutiæ of an experiment, as the slightest change of the conditions is liable to spoil everything.

A *habit of exactness* is of the utmost importance. When I say exactness, I mean not only the correct reading or recording of instruments and data, but I include the little extra precautions, such as keeping all instruments out of the way of draughts, or noxious fumes, etc. Dampness may often be an impediment in the path of success, and it is astonishing how a little calcium chloride or glacial phosphoric acid will help along the correctness of results. This may seem a trifle, but I know of a case where the want of an absorbent of moisture ruined a month's work.

Convenient jars for holding the delinquescent material may be made from a small china match holder, which, when not in use, should be securely closed with a well paraffined cork. A cement composed of equal parts of beeswax and resin, melted together and poured while hot over the cork, will effectually prevent moisture from entering the jar and spoiling the contents for future use.

A New Controller for Railway Motors.

The Thomson-Houston Electric Company has for a long time been engaged in experiments, having in view the development of a controller for railway motors that would be an improvement on those now generally used.

The principle upon which the new controller is based is the shifting of the connections of two motors from series to multiple, so that for slow speed the two motors will be in series, giving in consequence a high counter electromotive force (that of each motor being in series with that of the other) at a low rate of speed, while for higher speed they are connected in multiple,

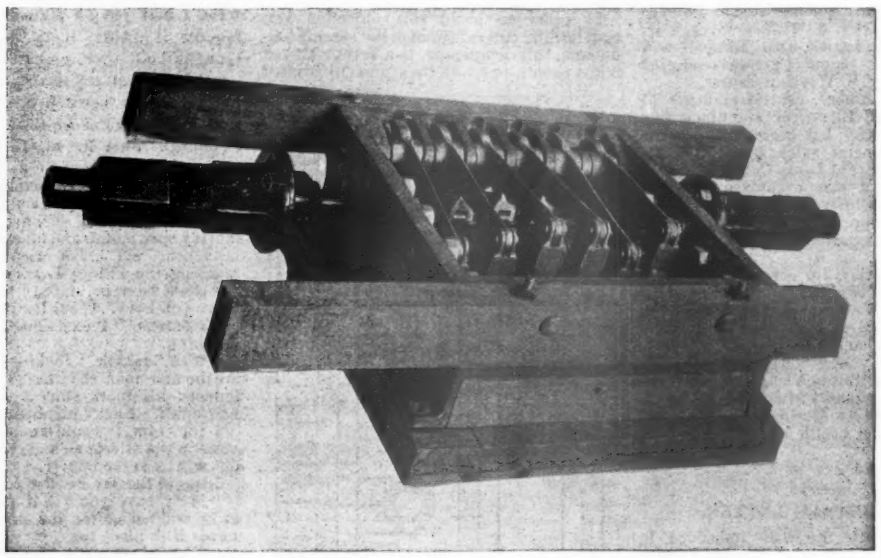


FIG. 1.—TOP VIEW OF THOMSON-HOUSTON CONTROLLER FOR RAILWAY MOTORS.

in which condition highest speed and power are obtainable with equal economy.

In the accompanying illustrations, the general form of the apparatus which the company has adopted for affecting these changes is disclosed. Fig. 1 shows a top and Fig. 2 a bottom view of the new controller. As will be readily understood from an inspection of the illustrations, the apparatus consists of a longitudinal shaft, acting upon a series of switch levers, to produce the various connections necessary to place the motors in series or parallel. This controller is to be placed at any point beneath the car and operated by a mechanical connection from either end of the vehicle. In this apparatus the mechanical and electrical details have been worked out with the greatest care, and it was permitted to go on the market only after satisfactory tests had been made, proving the efficiency and reliability of the device.

The Thomson-Houston Company has for some time owned controlling patents of this type of controller; the most important being No. 385,055, dated June 26, 1888, and No. 393,322, dated November 20, 1888.

PERSONAL.

Mr. H. T. Paiste, the well-known Philadelphia switch manufacturer, visited New York last week.

Mr. H. A. Cleverly, of Philadelphia, spent a day in New York last week on his way home after visiting Boston and the East.

Among recent visitors to Chicago were Mr. Thos. C. Wood, president of the Ball & Wood Company, New York, and Messrs. Rudolf Eickemeyer and Stephen D. Field, of the Eickemeyer-Field Company, Yonkers, N. Y.

Mr. W. R. Brixey, general manager of the Kerite Insulated Wire Company, is a visitor to this city each week from the factory at Seymour, Conn., making his headquarters in the handsome suite of offices of his company in the new *Mail and Express* building. Mrs. Brixey and her son sailed for Europe last week to enjoy a visit of several months abroad, leaving the husband to toil with the rest of us during these hot days in this great metropolis of the United States.

The Railway Equipment Company.

After much trying delay, the Railway Equipment Company, successor to the Electric Merchandise Company, Chicago, is ready to welcome its patrons to its elegant quarters in the Pullman building. The rooms have been in the hands of the decorator and finisher for several weeks, and everything possible has been done to make them beautiful and comfortable.

The offices front upon Michigan avenue and are on the ground floor. To the immediate left of the entrance is what might be called the visitor's parlor—a space enclosed by a neat railing and containing table and chairs for the comfort and convenience of callers. This office, fronting on Michigan avenue, makes a pleasant waiting room for visitors. The general manager's office is also in front and just back of the visitor's parlor, and is well lighted and ventilated by one of the large avenue windows.

To the rear of the general manager's office is that of the secretary and treasurer, agreeably accessible to customers. Next in order upon the right is the bookkeeping department, with the necessary desks and files. Enclosed by the bookkeeping department is a neat space for the use of the stenographers. The purchasing agent occupies the rear of the main office on the left, where he is conveniently near the store-rooms and shipping department. A youthful usher at a desk to the right of the doorway is at your service upon your entrance. The same side of the office furnishes enclosed desk room for the salesmen, and also space for a large show board, where is exhibited all the various pieces used in electric railway construction. If one desires to see quantity, rather than to examine the quality of the company's wares, a door at the farther end of the offices admits him to a store-room, where bins and shelves filled with the many devices handled by the house, line the walls. Much of the more bulky material is kept in the spacious store-rooms in the basement. The rooms are well lighted by electricity throughout, and will make a delightful home for the new company. Moving into such commodious and pleasant quarters is the natural outcome of the growth of this company's business, and a witness of its popularity with the trade.

Three years ago, under another name, but with the same general manager in charge, it started in a unique business, the handling of electric railway supplies exclusively, and since then has done an ever-increasing business. Less than a year ago its quarters were found to be insufficient and were doubled; again it became necessary to better its facilities. A great majority of the electric railways of this country are its regular customers.

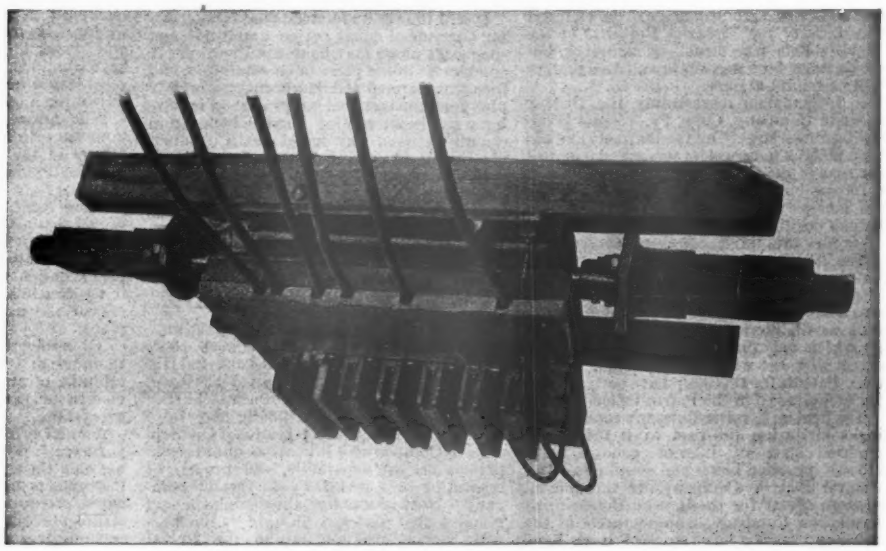


FIG. 2.—BOTTOM VIEW OF THOMSON-HOUSTON CONTROLLER FOR RAILWAY MOTORS.

Irrespective of the pushing qualities of the company, its prosperity is undoubtedly largely due to its honest intention to furnish the best possible quality of material to purchasers. That it is imbued with a progressive spirit is evident from the frequent improvements in its devices and the continual additions thereto. All friends of the Railway Equipment Company and of its general manager, Mr. W. R. Mason, will extend congratulations upon the appearance of its new home and its bright prospects.

The Fulmen Arrester.

BY C. S. VAN NUIS.

Realizing the difficulties to be overcome in designing an arrester which would stand repeated discharges of lightning from the overhead conductors of a street railway circuit, a series of experiments were begun on fuse arresters, where part of the circuit would be sufficiently weak to give way under the abnormal load of a short circuit, and thus prevent injury to the rest of the line and apparatus.

For this purpose a magazine fuse was provided, which would automatically bring into position, successively, a series of fuses; but

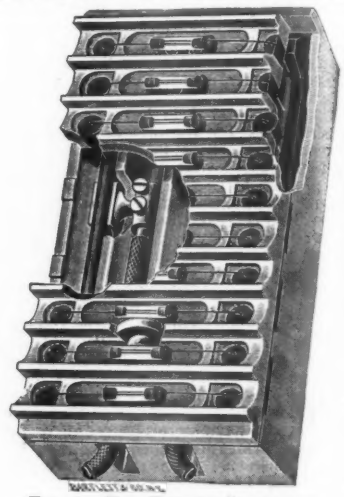


FIG. 1.—THE FULMEN LIGHTNING ARRESTER.

the same discharge plates were used for all, which feature made the apparatus less effective than was desired when used to protect high potential circuits, because the dischargers became slightly impaired with each discharge.

Having progressed this far, it was only a step to include the dischargers in the fuse wires, making the complete arrester destructible with each discharge, and, having but once to act, it would be in the best possible condition for that particular discharge.

FIG. 2.—SECTION OF FULMEN ARRESTER.

It is upon this principle that the Fulmen arrester is constructed which is shown in Fig. 1. Two small brass wires are hermetically sealed into a glass tube so that they are electrically disconnected, though separated by only one-twentieth of an inch at the center of a three-quarter inch lap. These form the dischargers and are always clean and dry.

By connecting one of the outer ends of this arrester to line and the other to ground, one of the simplest known forms of arrester is provided.

This is accomplished by providing each fuse with two soft rubber plugs, so spaced by the knots in the wires that the rubbers will fit tightly into the porcelain cover of the arrester box (see Fig. 2), allowing the free ends of the wires to project through the cover into the channels of the porcelain box containing the carbon terminal rods; but they do not come into contact with the latter.

Ten fuses are considered enough to protect one locality during one thunder-storm, and each arrester box is provided with that number.

To bring the top fuse into operative position, a pair of wedge-shaped pieces of carbon are allowed to rest on the free ends of the fuse, and to bear against the carbon terminal rods, which connects the respective ends of the fuse to line and ground.

With nothing to impede its course but an air gap of one-twentieth of an inch, a lightning discharge finds a free path to earth over this fuse arrester. The discharge starts an arc, which short-circuits the line at this point, and the sudden rush of current is sufficient to entirely consume the fuse.

The destruction of fuse number one causes the carbon wedges to drop and connect fuse number two to line and ground, and each of the ten fuses is successively brought into circuit in the same manner.

New fuses may be readily inserted by removing the cover, and, after being refilled, it is replaced with the carbon wedges connecting the top fuse, as before.

Series Electric Traction.

ABSTRACT OF A PAPER READ AT THE GENERAL MEETING OF THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS, CHICAGO, ILL., JUNE 6–8, 1892, BY NELSON W. PERRY, E. M.

It is my purpose to show how the constant current system may be made as elastic in every way, at least on paper, as the constant potential, without sacrificing in any way any of the advantages peculiar to the system, and how it is possible to make each unit in such a system nearly, if not quite, as independent of every other unit as is the case in the system now in vogue.

The most ambitious and painstaking, and withal successful attempt, up to the present time, to adapt the series or constant current method to electrical traction was that made by Prof. S. H. Short, now of Cleveland, Ohio, and he actually constructed and operated for a considerable length of time, and with some success, two roads, one a single track road at Huntington, W. Va., connecting that city with Guyandotte, about three and a half miles distant, and the other a belt and double track road on South Broadway, St. Louis, which was, I think, about three miles in circuit. Professor Short employed two wires, divided up into sections of any desired length, but necessarily not less in number than the number of cars to be operated. These sections were connected together by switches operated by a peg on the trolley mast, the peg on one car throwing the switch in one direction, and that on the succeeding car throwing it in the opposite direction. The current coming up one line of wires, crossed over through the motor to the other line, by which it was carried to the next car motor, through which it passed back again to the original line of wires. Each car as it passed a switch set it so that the current in the section it was entering would come up on the same wire as it had in the section just left, and the succeeding car would set the switches so that the current would come up to it on the opposite wire, and so they alternated.

Since the continuity of the circuit depended upon the presence of a motor between the two lines, if either of the trolleys got off its wire, the circuit was broken and all cars had to stop for lack of current.

Since the switch must be thrown to opposite wires by each succeeding car, if one car failed to do this, as would be the case if an odd number of cars were added to or removed from the line, it would again become broken by reason of the failure to throw the switch in the proper direction. Cars had, therefore, to be added to or removed from the route in even numbers. This precluded the inter-communication of two or more systems, for the reason that if a car was run out from one line onto another it would be a case of the removal of an odd number to the other line, and both lines would become broken. So, too, it was impossible to operate a branched road on which part of the cars took one branch and a part the other, for the succeeding car, after it passed the forks, whichever route it took, would either break the circuit itself, by reason of failure to properly turn the switch, or would leave the switches in such a position that they could not be operated by the next car.

On a single track road where the cars passed each other on sidings, it was necessary to wire the whole route, as though it were a double track road, the cars going up one pair of wires and returning on the other which followed the siding. This was the case at Huntington, where, although there was but a single siding, perhaps 50 feet long, where the two cars passed each other, the whole three and a half miles had to be double wired to enable them to pass, else the two cars would be thrown into multiple with each other and neither could run. I succeeded in devising a means by which, if there were but two cars and one siding on the road, the only double wiring required was at the siding, but the plan failed where more cars and sidings were involved.

In Short's system the switches were purely mechanical, exposed to the vibration of the trolley wires and to the elements, and had to fit tightly, else they would burn out. If they fit sufficiently tightly to obviate this, they were liable, through corrosion or ice or some other cause, to fit too tightly and fail to operate, in which case the line again became broken.

I speak more freely of the defects of the Short series system from the fact that it has been abandoned by the Short Company, and because its failure has been officially announced by its projectors. My object in dwelling upon it at such length being to point out more clearly some of the defects that must be remedied before the series can become a practical working system.

The system which I am about to explain may properly be described as consisting of a circuit interrupted by a series of breaks in multiples of two. Or one consisting of a circuit interrupted by breaks in multiple series with each other—the breaks being in multiples of two. The conception then would be like Fig. 1.

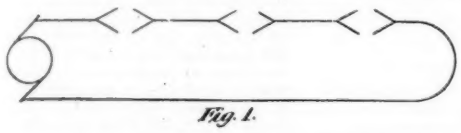


Fig. 1.

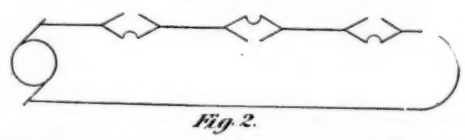


Fig. 2.

But in order that a current shall pass around this circuit, it is necessary that *one* of the breaks in each multiple shall be normally closed. It matters not which one is closed, so our plan would now look like Fig. 2.

If a translating device should successively occupy each of these breaks it would receive current during the time that its terminals connected the ends of the two broken wires in proportion to the relative conductivity of the two paths open to the current.

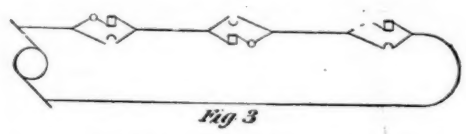


Fig 3

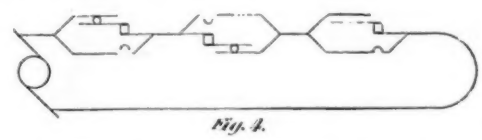


Fig. 4.

But we are not satisfied to have a portion only of the current pass through our motor—it is necessary that *all* the current must so pass. We must, therefore, make the resistance of the other branch infinite during the time in which the motor is bridging, through its terminals, the break, or, in other words, the normally closed branch must be broken.

If, therefore, we place an electro-magnet in series with the normally broken branch, so that when vitalized it will open the switch in the normally closed branch and allow it to close again by gravity or otherwise, when the magnet is devitalized, we have provided in a crude way for operating traveling translating devices in series. Our conception now would be represented somewhat by Fig. 3.

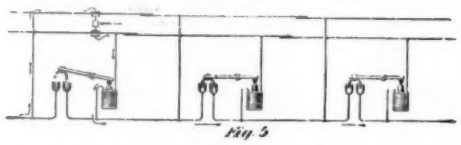


Fig 5

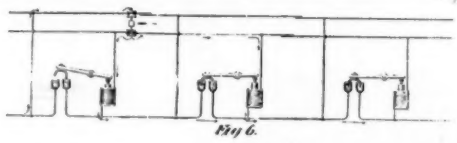


Fig 6.

By this arrangement, the moving device only receives a momentary impulse as its terminals touch the ends of the break, and would have to rely upon its acquired momentum to carry it to the ends of the next break. It will be apparent, however, that it is immaterial whether the device receives its next impulse by closing the next break in the circuit or whether it skips that one and gets it from any other break, either on that circuit or from one connected with an entirely different dynamo. It is this feature that permits the use in my system of sidings on single track roads, and of forks (the skipping of one or more breaks) and the inter-communication between separate circuits (the jumping from a break on one circuit to a break on another).

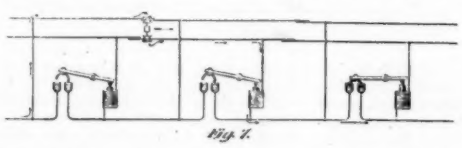


Fig 7.

It is desirable, however, that the moving device be impelled by as nearly a continuous force as possible, instead of by a succession of momentary impulses. Instead, therefore, of having the ends of the normally open break face each other, as represented heretofore, we may extend these wires for some distance parallel with each other, and our plan assumes the form shown in Fig. 4.

And it is desirable that the interval of time during which the device is without current, viz., that occupied in passing from one break to the next, shall be as small as possible. This naturally suggests having normally open breaks all on the same side of the normally closed breaks, and if these parallel wires be continued so as to overlap those constituting preceding and succeeding breaks, a car or other moving translating device may pass from one break to another without even momentary interruption of current. In Fig. 5, the lower line, which I call the "feeder," contains all of the normally closed breaks, represented by mercury cups normally connected electrically by a fork taking into them, which constitutes a double pole switch actuated by an electro-magnet in the manner to be described.

The upper pairs of wires, which it will be seen are merely the parallel extensions of the other possible path for the current, are in multiple with the path through the mercury cups. One of each of these pairs of wires, which will hereafter be denominated sections, is connected to the feeder wire on one side of the mercury cups, and the other has a similar connection on the other side. The two wires of each section, normally without electrical connection with each other, constitute what has been termed the "series of breaks normally open." If, however, these two wires be connected electrically through the terminals of a motor, the latter will be in multiple with the mercury cups and momentarily receive only the current due to the relative conductivity of the path thus offered. By the arrangement shown in Fig. 5 the electro-magnet which opens the mercury cup switch is in series with the motor circuit, and the latter no sooner receives current than the former is actuated, the switch is opened and the whole of the current, which was momentarily divided between the two branches, is diverted to the motor.

If the corresponding wires of the succeeding sections be caused to overlap without making electrical connection with each other, and these laps be staggered as shown, a means is provided whereby the motor prepares the succeeding section for occupancy before wholly passing out of the one it is about to leave, and accomplishes this without interruption to the current. Figs. 6 and 7 show how this is done, and the arrows show the paths taken by the current as the transition takes place. When the motor is in the position represented in Fig. 5 there is but one path for the current, viz., around the open switch in the feeder and through the electro-magnet, by which it is kept open, back again to the feeder.

As the motor proceeds to the right, one of the terminals first embraces the lower lap, thus offering two paths for the current—one passing through the switching arrangement that controls the section the car is about to leave, and the other through that controlling the section it is about to enter (see Fig. 6). As it progresses still further this terminal passes beyond this lap at about the same time that the other terminal embraces the other lap. This leaves the first switch without current, and the succeeding switch is automatically opened. There is no break in the circuit, however, even during the short interval occupied by the two switches in acting, for, while the further terminal embraces the further lap, both of the switches concerned are short-circuited, as shown in Fig. 7. Before the further terminal has passed beyond the lapping portion of the two succeeding wires, the first switch will have closed and the succeeding switch will have been opened, thus diverting all of the current to the section upon which the motor has now entered.

Fig. 8 shows another arrangement by which a motor is enabled to pass from one section to another without interrupting the circuit. In this arrangement the ends of the sections while mechanically continuous are electrically disconnected but do not lap as before. The break in the wires connected with the switch-actuating device is longer than that between the other two wires. The larger gap, however, is lapped by a subsidiary conductor, which short-circuits the switch actuating the section the motor is about to enter, as shown. As the car proceeds from left to right, before both its trolleys have passed off the section, one of its trolleys has embraced the subsidiary conductor and the electro-magnet controlling that section is cut out of circuit and the switch drops. While the switch is dropping, however, the current continues to flow through the companion wire, through the motor to the subsidiary wire and *around* the switch actuating the section it is entering. Fig. 8 represents a branched or forked road operated by a single dynamo. In the arrangement shown in Fig. 8, where the branch road is operated by the return circuit, a car turning to the left would really skip from the first section of the road to the very last, if we count them in the order in which they receive current, whereas in going straight ahead it would pass from section 1 to section 2, etc., counting them in the same order. In Fig. 9, however, which represents a similar road operated by the loop system, a car taking the left hand branch would pass from section 1 to sections 2 and 3, whereas, if it went straight ahead it would pass from section 1 to sections 4 and 5. It will be apparent from what has preceded that in neither of these cases does the skipping of one or many sections involve an opening of the circuit.

But, returning to Fig. 8, and following the car still further in its progress from left to right. We left it standing with one trolley on the further wire and the other on the subsidiary or short-circuiting conductor. In this position the current will continue to pass through the motor only so long as the switch actuating that section requires to fall into the mercury cups. Immediately that has occurred, which will be accomplished before the further trolley has passed from its wire, the motor will have been short-circuited and the car will, by its acquired momentum, pass from the system without sparking or other disturbance of the circuit. If the acquired momentum should carry the car to another section of the same system, or to a section connected with an entirely separate system, all that is necessary to enable it to proceed would be some arrangement by which the switch controlling the section upon which it was entering, could be opened by the entrance of the car itself. It will be evident from Fig. 10, which represents two connecting roads operated by separate dynamos, that it matters not, as far as the integrity of either circuit is concerned, whether the car goes to the left or to the right; in either case the circuit is closed before it leaves a section, and as it enters the succeeding section it does so before opening the switch,

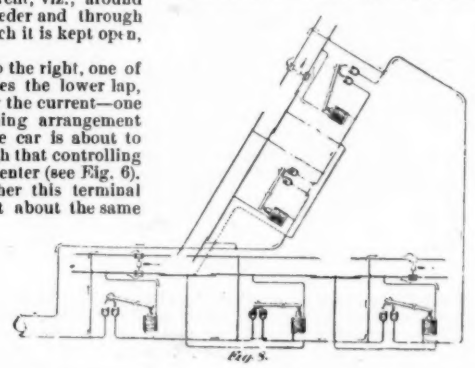


Fig 8.

which actuates that section, and it is entirely immaterial whether that section belongs to the same system as the one just left, or to one entirely foreign to it. If only the proper switch can be opened the car may proceed on its way on either system of roads. In order to accomplish this automatically, each car may be provided with some such an arrangement as is shown in Figs. 11 and 12. M is a solenoid magnet in series with the motor D; L is a lever pivoted at P and playing between two stops, but, when not actuated by the plungers of M, kept in contact with the lower stop by the spring S; B is a local battery; W, W^1 are the trolley wires, and C is the mercury switch connecting adjacent

sections of the feeder wire. As long as the motor is receiving current from the feeder, as is the case in Fig. 11, the current must pass through M, which, by its pull on the plungers, maintains the lever L against the upper contact. As the trolleys pass off from a given section and the motor loses its currents as before described, the spring S causes the lever to make the lower contact (Fig. 12), thus throwing the battery B into the circuit, W, F, C, F^1, W^1. The moment

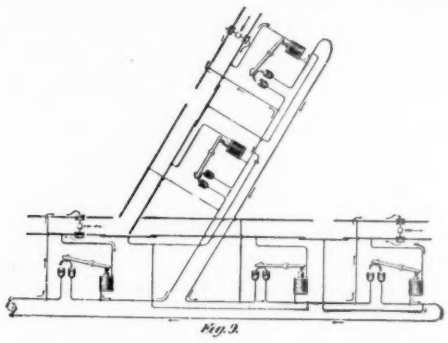


Fig. 9.

the trolleys enter upon a new section this circuit is closed, the local current passes through the feeder switch magnet and opens the switch C and diverts the current from the feeder to the section just entered. This strong current actuates the lever L, again bringing it against the upper contact and cutting the battery B again out of circuit. Since the battery B is only momentarily in circuit, the cost of maintenance will be insignificant.

On single track roads where turnouts are required, the turnout constitutes merely an additional section to one side of the main line, which is skipped by the car keeping the main track, and taken by the other car in passing. It, like every other section, has its own individual controlling switch, and when both the main track and sidings are occupied by cars, their motors are arranged in series with each other, as represented in Fig. 13. By following the arrows, the course of the current can readily be understood.

But both of the plans thus far discussed possess serious faults. In both we have provided a means by which a car may leave one section on a given road and enter another one on the same or another road without breaking the main circuit, *provided the car is always going in the same direction.* In all of the cuts thus far, the car is supposed to be going from left to right, and the switches are arranged accordingly; but, if we examine the drawings again, it will be found that in the plan suggested in Figs. 5, 6 and 7, if the car were going in the opposite direction, the circuit would be momentarily broken as it left one section and would fail to divert the current to the section it was entering. In the second plan, outlined in Figs. 8, 9, 10 and 13, the car is momentarily without current whenever it passes from one section to another.

By combining the two plans, however, all of the difficulties seem to be removed. Figs. 14 and 15 show how this combination is effected, and the courses of the current when the motor terminals are in different positions on the wire. It will be noticed that, as in the first plan described, the trolley wires of adjacent sections are lapped, and that these laps are staggered; that parallel to, but insulated from, the nearer laps is placed the subsidiary wire, which short-circuits the switch to the right. The switch controlling magnet, as is shown, has two coils wound

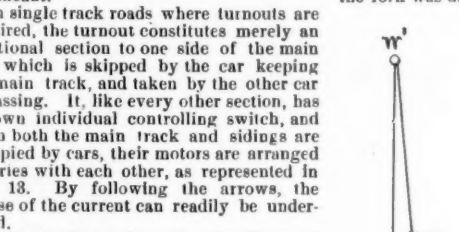


Fig. 13.

cumulatively, and may be operated either by the current passing through the subsidiary wire, by that passing through the nearer trolley wire, or by both, when it takes both paths.

The supplemental conductors and the laps in the trolley wires are so arranged relatively to each other that when a car is traveling in the direction of the main current, as the trolleys approach a lap, the trolley traveling upon the wire connected with the switch, will contact with the supplemental conductor before reaching the lapping portion of the trolley wires, and the companion trolley will reach its lap after the first trolley has reached its lap and before it has passed beyond the supplemental conductor, while, with a car traveling in the opposite direction, the order will be reversed, the trolley upon the wire *not* connected with the switch, first reaching its lap, after which its companion trolley reaches first its lap and afterward the supplemental conductor. By this arrangement, in whichever direction the car may be going, in passing from one section to another, it first short-circuits the switch controlling the section it is about to enter, next diverts a portion of that current to that switch, and, finally, all of it, cutting the switch controlling the section it has just left entirely out of circuit. In this manner the transition is accomplished in either direction from one section to another, either of the same or another connecting road, without spark or interruption of circuit. Should either one or both trolleys leave the wires, or the circuit through the motor in any other way become broken, the magnet controlling the switch to that section would be left without current and the forks would immediately drop into the mercury cups, renewing the circuit through the feeder wire almost instantaneously. There would, however, be an interruption of the current while the fork was dropping. Even this slight interruption may readily be avoided by connecting with the switch any of the devices so successfully employed to obviate the same difficulty in arc light circuits.

Should a second car run upon a section already occupied, the two would be thrown in parallel and both would stop. This arrangement, therefore, constitutes a most perfect automatic block system, not dependent upon frail human nature, but sure and positive in its action. On interurban electric roads, where it is even now proposed to reach greater speeds than are customary or attainable with steam locomotives, the importance of this feature cannot be overestimated. Not only will collisions be rendered practically impossible, but, by putting semaphores or other signaling devices in the wires connecting the main feeder with the two trolley wires, each car as it enters a section will automatically set a signal at each end of that section showing that the section is occupied, and when it has left the section, set another, indicating that the way is clear. These signals cannot fail to act, for, being in series with the motor, they *must* receive current when the motor does, and lose it when the latter has passed out of the block. This seems to be the solution of the block system, as it eliminates all the uncertainties inseparable from a dependence upon human intelligence and watchfulness.

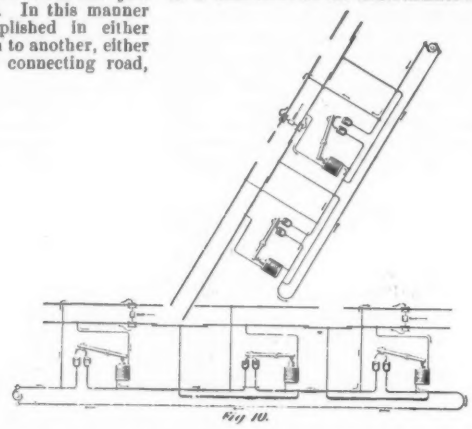


Fig. 10.

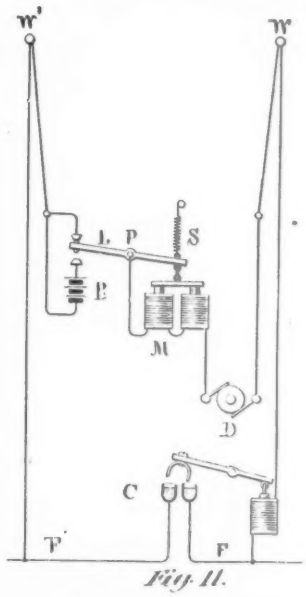


Fig. 11.

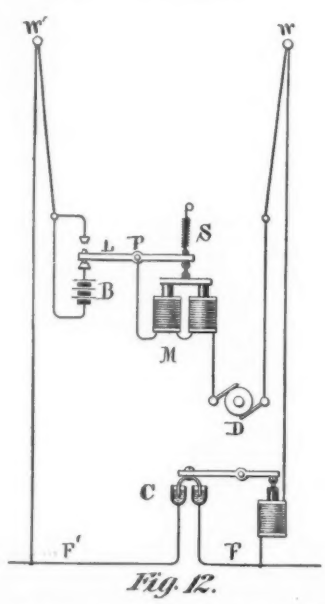


Fig. 12.

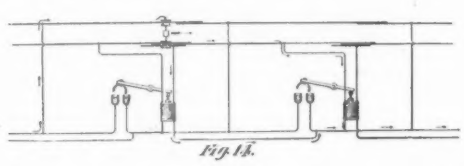


Fig. 14.

This system will no doubt be criticized, first, on the score that it is a double trolley system, which many are opposed to on general principles, and second, on the score of the high potentials necessarily involved in series distribution to long distances. Anticipating these, I will say, in regard to the first, that however valid the objections may be to the double trolley on multiple arc roads, they have but little force as applied to series circuits. In the latter, since both the wires on all sections not occupied by cars are of the same potential, the difficulties of insulation of the one from the other disappear entirely. Then, again, I am satisfied, with an intimate knowledge of the electric roads in Cincinnati, where with one exception they are double trolley multiple arc roads, that most of the objections raised against them are greatly magnified. They certainly have the decided advantage over the single trolley of being independent in their operation of the condition of the track. Their chief objection being the difficulty of insulating the positive and negative wires from each other (which we have seen does not hold in series roads), and the multiplication of wires, crossings and switches, where many lines converge and cross. In suburban districts, where these complications do not occur (and this system is particularly adapted to such), the double trolley multiple arc system is in many respects superior to the single trolley. Mr. John Kilgour, President of the Cincinnati Street Railway Company, is justly proud of the Avondale double trolley road (a suburban line), and I doubt if there is a more successful road in the country than this.

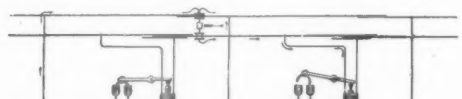


Fig. 15.

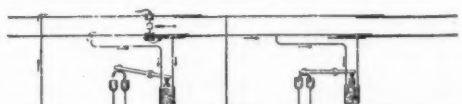


Fig. 16.

In regard to the other objection to the series method, viz., the high potentials, the method outlined in this paper permits the ues of any number of feeders, each of which may be used to supply a different portion of the road, thus reducing the potential, which in series distribution is the variable quantity, in the same manner exactly that the "drop" is obviated in parallel systems.

It is perfectly clear to the members of the Institute that this question of potential on series circuits is very much misunderstood by the laity. In the parallel system of distribution, the high potential impressed upon the circuit at the dynamo is carried to every translating device on the circuit even to that at the extreme end of the line, whereas, in a series circuit, the high potential spoken of exists only at the dynamo terminals and is the sum of the electromotive forces consumed by all the resistances on the line.

As an illustration in point, supposing we have two circuits—one parallel and the other series, the differences of potential between the terminals of the two generators being exactly the same—let us say 2,000 volts. On the multiple arc circuit, no matter how insignificant the translating device may be, or where it is located, one cannot handle its terminals without subjecting himself to a shock due to 2,000 volts. If the motor be generating one horse-power or 100, the danger is exactly the same. On the other hand, in the series system, if we are using a current of, say, 40 amperes, which is a convenient one for street car purposes, if the motor be generating one horse-power, the difference of potential between its terminals will be a little less than 19 volts. If it be generating 100 horse-power, it would be but 1,865 volts, and before it would be as dangerous to handle as a motor on the multiple arc circuit, it would have to be doing work equivalent to 107 horse-power.

LITERARY.

Dr. Leroy M. Yale, an angler of great experience, writes a very attractive article in the July *Scribner's*, entitled "Getting out the Fly-Books." The decorations are his own.

We have received "Transactions of the Canadian Institute," for April, 1892, an annual archæological report submitted to the Institute, and "an appeal to the Canadian Institute on the Rectification of Parliament," by Dr. Sandford Fleming. The sum of $1,000 has been placed at the disposal of the council of the Canadian Institute to be awarded in whole or in part by the Institute for the best workable measure (bill or act of Parliament) which, if made law, would give the whole Canadian people equal representation in Parliament and each elector due weight in the Government, through Parliament.

The current issue of "The Weekly Bulletin of Newspaper and Periodical Literature," published at 5 Somerset street, Boston, is twice its usual size, containing a classified index of 1,300 articles from recent numbers of the periodical press. The "Bulletin" catalogues the important articles in the leading daily and weekly papers and the monthly magazines of the United States and Canada, including the ELECTRICAL REVIEW. Its value to readers, writers and students, is sufficiently indicated by its title, and, although still in its first volume, its success, as evidenced by the current issue, is a surprise to no one acquainted with its plan and purpose.

The leading topic of political interest in the *North American Review* for July is, "What Shall the Ratio Be?" Senator Stewart, of Nevada, Representative Springer, of Illinois, Senator Hansbrough, of North Dakota, Representative Bland, of Missouri, and Representative Dalzell, of Pennsylvania, unite in the expression of the opinion that a ratio of about 15½ to 1 will establish the parity of gold and silver, and it seems to be clear from the statements set forth in these articles that should the coming International Monetary Conference take definite action on this basis, the silver question will be solved to the financial convenience and betterd condition of the mercantile world.

A Big Suit May Spoil the Deal.

The electric light companies at Kansas City, Mo., which were scheduled to consolidate their respective interests with that of the gas company, are apparently likely to have trouble. Suit has been commenced through injunction proceedings by the Kansas City Electric Light Company against the American Electric Light Company, of Kansas City, the Thomson-Houston Electric Company, of Connecticut, and the General Electric Company, of New York. The Kansas City Electric Light Company asks that judgment be awarded to it for $60,000 against the American Company, and the Thomson-Houston Company for $60,000, and for $150,000 against the General Electric Company.

The contract between the founders of the plaintiff company on November 14, 1881, owned by William Parket, president; Jos. J. Skinner, secretary, and J. S Chick, trustee, provided that for the apparently moderate consideration of $4,000 the American Company should grant Messrs. Parket, Skinner, Chick and others the exclusive license to sell, rent or use, in Jackson County, Mo., and Wyandotte County, Kan., the apparatus, machinery, lamps, etc., of its manufacture for purposes of electric lighting, electroplating or power, under United States letters patent No. 233,047, or any other patents then or thereafter controlled by the company. On the other hand Messrs. Parket, Skinner, Chick and others bound themselves to use reasonable diligence in introducing and extending the use of the articles in question and not to use, buy, sell or rent the machinery, etc., designed for electric lighting, etc., from any other concern.

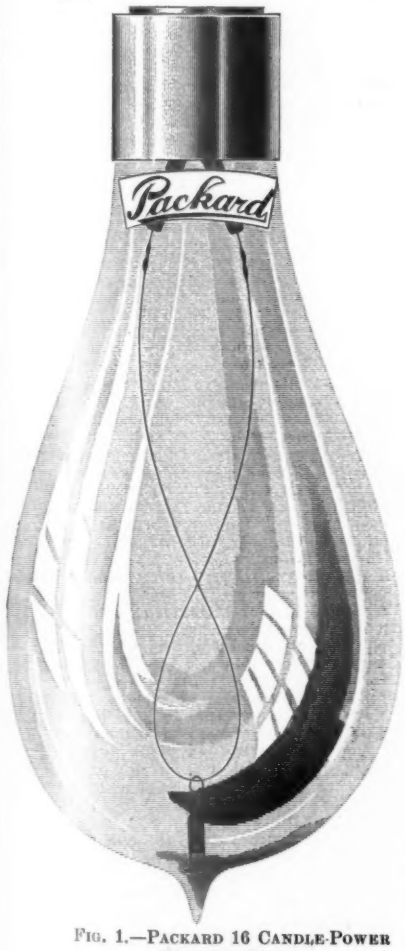


FIG. 1.—PACKARD 16 CANDLE-POWER RAILWAY LAMP.

The Thomson-Houston Company, having bought out the American Company, became, it is alleged, liable for the obligations of the latter; and the General Electric Company having bought out recently the Thomson-Houston property is further liable.

It is stated that an automatic regulator is at the bottom of the whole trouble, the Kansas City Electric Light Company claiming the exclusive right of the adjunct for Jackson and Wyandotte Counties. The company ask the Circuit Court to award it judgment for $60,000 against the American Electric Light Company, of Kansas City, and the Thomson-Houston Electric Light Company, and for $150,000 against the General Electric Company, and that an account of damages be taken, and that the American Company be restrained from using, and the other two companies be enjoined from selling the apparatus, machines, etc., with regulators attached, to any one else in Jackson County, Mo., and Wyandotte County, Kan.

Electric Lighting in Holland.

Since 1888 Amsterdam has had a small central station supplying 2,000 sixteen candle-power lamps distributed in the central part of the city only, says a foreign exchange. The Proprietary Electric Company, to which the station belonged, obtained in 1890, a concession for supplying current throughout the whole city during a period of 28 years, and on May 14, the company opened a new central station, in which the alternating current system is exclusively adopted. The dynamos are of the Ganz type, built by the Helios Company, of Ehrenfeld, Cologne. They generate the current at a pressure of 2,000 volts, with 100 periods per second; the larger ones develop 400 kilowatts each. The smaller dynamos are of the same type, and are respectively 200 and 75 kilowatts, giving a total of 1,500 kilowatts. The exciters are four-pole compound dynamos with Gramme-wound armatures. They develop 20 kilowatts at 65-100 volts tension. All the magnets of alternating and direct current dynamos have laminated iron coils. The transformers have also been manufactured by the Helios Company; they have a closed magnetic circuit, and transform from 2,000 volts down to 72 or 36. The latter is for the arc light, so that two arcs in tension may be supplied at the same time. At present 6,100 sixteen candle-power lamps are being supplied. The small station in the city will be closed, and the overhead wires that have hitherto supplied a portion of the current to consumers will be removed.

Westinghouse News.

The Westinghouse Electric and Manufacturing Company has leased the old works of the Westinghouse Air-Brake Company, including the foundry, for four per cent. upon a reasonable valuation. The works are fitted with shafting, and machinery can be moved in suitable for the new purposes. These works will add about 50 per cent. to the producing capacity of the company and enable it to employ some 2,500 men. The foundry will be of especial value, as it will enable the company to perform certain work which it now has done outside, and at a saving of expense estimated to equal the rental of the leased works. The company's railway business has grown enormously. It contemplates doing railway work at the Newark factory in addition to the leased works. The settlement with the Birmingham Street Railway Company, of Pittsburgh, in the matter of the trolley, is said to be upon the basis of the abandonment of the other systems for the Westinghouse system.

An agreement between the lamp committee of the Rochester, N. Y., common council and the electric light companies has been reached. By the terms of the contract each arc light will cost the city 25 cents per night for the next five years. The contract contains a clause which provides that the companies must put their wires in certain specified territory underground within 60 days after receiving written notice from the council to do so. There are at present on the streets of the city 482 gas lamps, 932 Brush arc lights, 383 Rochester arc lights, 157 Edison arc lights and 593 Edison incandescent arc lights. The prices paid according to the present contract are: Brush, 27, Rochester, 28½ and 27, Edison arc, 28½, Edison incandescent, 6, Rochester gas, 6½ cents. The total cost for street light last year was $160,285.

The Packard High Grade Incandescent Lamp.

Among the numerous lamps that have entered the electrical field during the past two years, the Packard "High Grade" has grown steadily in favor, for we hear everywhere words of praise. A central station reported a test of 13 lamps, in which the average life was 2,934 hours, lowest life 1,868 hours and highest life 4,696 hours.

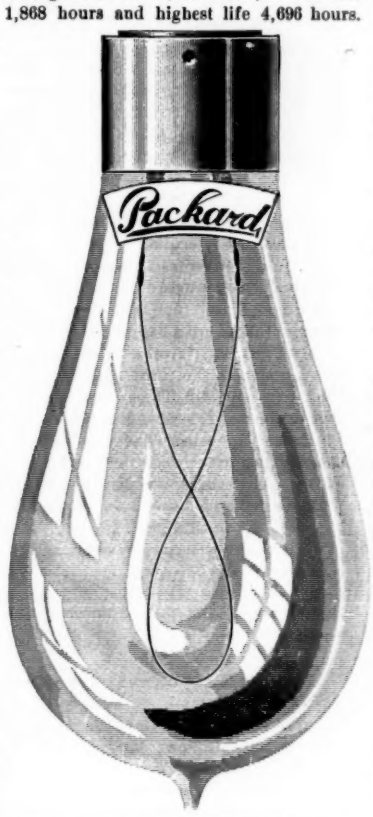


FIG. 2.—PACKARD 16 CANDLE-POWER INCANDESCENT LAMP.

Another station reports a reduction of 50 per cent. in breakage (or burned out) lamps since the adopting of the Packard. The price of such a lamp is a small factor.

The results are accounted for in the fact that great care and very careful superintendence is given every detail of the manufacture. Messrs. J. W. and W. D. Packard have had long experience in the lamp business, being practical in all its branches, and they stand high as inventors of special machinery necessary to the manufacture of incandescent lamps.

The lamp is manufactured by the New York and Ohio Company, of Warren, O., and we present to our readers, through the courtesy of Mr. Charles E. Chapin, the general Eastern agent, illustrations of the ordinary 16 candle-power lamp and railway lamp.

May This Catch the Eye of the Man Who Borrowed Ours!

Hojack—Where is that umbrella I lent you last week?

Tomdik—It's at home. Why do you ask?

Hojack—The man I borrowed it of says that the owner has been asking for it.—*New York Sun.*

Quick Work by an Electric Contractor.

A remarkable installation was recently made at White Plains. A very handsome new church was presented to the parish by Mrs. M. C. Reynal, and the architect, Mr. T. H. Poole, of New York city, contracted with one of the large electrical manufacturing companies to put in wiring and fixtures for electric lights, and made arrangements with the local lighting company to install a special dynamo and supply current.

It was intended to use the lighting plant at the consecration exercises, but as that day drew near it was evident that neither company would be ready. The day before the exercises the architect concluded that he must have electric lights if it were at all possible. Having had satisfactory experience with a well known bulk electric contractor of New York city, the architect called upon the concern at 4.30 one afternoon and asked if it would be possible to install the plant and have it running in time for the exercises which would come off at 10.30 the next morning.

It was necessary to secure, deliver at White Plains, and install the dynamo, complete the wiring of the church, run the line to the central station plant, alter the speed of the engine, supply belting, foundation, etc. The contract was promptly accepted by H. Ward Leonard & Company, whom Mr. Poole applied to at 4.30 in the afternoon, and at 10.15 the next morning the entire plant was operating perfectly. Architects and the public generally are beginning to appreciate that electric plants can be installed by bulk electric contractors with great rapidity and satisfaction.

"C. & C." Switches.

The accompanying cuts represent the single pole and double pole snap switches recently placed upon the market by the "C. & C." Electric Motor Company. The plain switches designed by this company have the same general appearance, the only important difference being the omission of the snap spring in the plain switch, while the handle lever and knife lever are replaced by a single casting.

Almost all specifications for electric lighting plants now call for marble or slate switchboards instead of the wood board, which was formerly considered satisfactory. The switches that were designed for the wood boards have been made to do service on the marble, but owing to their construction they do not make a handsome appearance. The switches here illustrated were designed specially for this class of work, and have been provided with ample contact surface and quick brake, and the metal parts are so solidly constructed as to obviate any possible danger of breaking.

FIG. 1.—"C. & C." SINGLE POLE SNAP SWITCH.

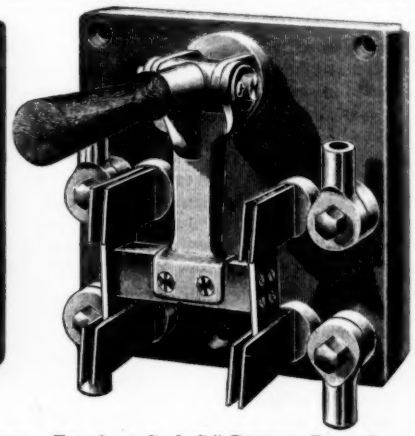


FIG. 2.—"C. & C." DOUBLE POLE SNAP SWITCH.

The connections are made from the back of the switchboard to these switches, but the contact binding posts are made extra long, so that when wanted the switches may be supplied to be fitted to a switchboard of any thickness.

On switches provided with fuse blocks and mounted on slate bases, the distance between the fuse terminals is made ample enough to render the fuses perfectly reliable and to prevent any danger of arcing across. This feature is specially desirable when the switches are used on 500 volt circuits.

RAILWAY TELEGRAPH SUPERINTENDENTS.

ANNUAL MEETING IN DENVER—ABLE PAPERS READ AND DISCUSSED—L. H KORTY, OF OMAHA, ELECTED PRESIDENT, AND MILWAUKEE SELECTED AS PLACE OF NEXT MEETING.

At the Hotel Albany, Denver, Colo., the annual meeting of the Railway Telegraph Superintendents was held June 15 and 16, in compliance with the instructions of the Cincinnati meeting last year. Mr. A. R. Swift, superintendent of telegraph of the C., R. I. and P. R. R., had made all arrangements for transportation from Chicago to Denver as outlined by General Manager St. John in his letter extending the courtesies of the Rock Island route to the Association. Two Pullman cars were provided and the party left Chicago at 6 P. M., June 12, arriving at Denver Tuesday morning, June 14. The first session was called to order at 10.30 A. M., June 15, by President C. S. Jones. The following new members were elected: G. R. Stanton, F. H. Benjamin, C. S. Rhodes, L. S. Wells, J. S. Evans, G. B. McCoy, W. W. Ryder, E. E. Rittenhouse, D. E. Matheson and J. H. Crawford. The following honorary members were elected: Messrs. J. J. Dickey, D. J. Higgins, Ralph W. Pope, Thomas D. Lockwood, T. R. Taltavall, T. A. Edison and Prof. W. F. Gardner. The following officers were elected to serve for the ensuing year:

President, L. H. Korty, Omaha, Neb.

Vice-President, U. J. Fry, Milwaukee, Wis.

Secretary and Treasurer, P. W. Drew, Chicago, Ill.

It was voted that the next meeting be held at Milwaukee, Wis., June 20, 1893.

Mr. S. S. Bogart read a paper on batteries in which he called attention to the adaptability of the Edison-Lalande battery for electric railway signal work. Its internal resistance was but one-tenth of an ohm, it was perfectly constant, would not sulphate and was not affected by low temperature. He believed the time had arrived when they should discard the sulphate of copper battery. He was using it for block signals in preference to all others. He used four cells in series, closed circuit, with a resistance of 10 ohms. There is tapped out of it a sounder, alarm bell and annunciator, the last two on the same cell.

At the close of Mr. Bogart's paper the meeting was visited by Governor Routt, of Colorado, who delivered an address of welcome which was responded to by President Jones.

The afternoon session on Tuesday was called to order at 2.45 P. M. The paper on "Insulation" by Mr. Edison was read by Mr. M. B. Leonard, and is published on another page.

Mr. T. D. Lockwood stated that he was pleased to note the statement that pure water was not a conductor, although in practice we could neither get pure water nor keep it pure if obtained. In New York city it was very difficult to maintain insulation on account of the steam pipes, and some cables after being laid were found weak in spots. It was found that very small particles of water were moved along by the heat. Condensation accumulated the moisture in one spot and made a leak. In reply to an inquiry by Mr. Gemmell, as to the practical use of oil insulations, Mr. T. J. Smith said that they were now made in this country but there had been little demand for them. They had, however, been highly spoken of by those who had used them.

The paper on "Time Signals," by Prof. W. A. Gardner, was then read by Mr. C. A. Darlton in the absence of the author, and will be published later.

Mr. Lockwood then gave a blackboard talk on "The Galvanometer and its Uses," which was devoted to a popular explanation of the handling of that instrument, especially for telegraph work. At the opening of the morning session on Wednesday, Mr. Chas. Selden read a paper upon "Electricity it its Relation to Transportation," which the REVIEW published last week.

Mr. Lockwood said that the railroad community at large owed a great debt to the Baltimore and Ohio Railroad Company, for its advance step in experimenting with the electric motor for use in tunnels, although it was not really an experiment. He did not look for the immediate application of electricity to trunk lines, but electricity was no exception to the rule that tall oaks from little acorns grow. He took the plan of Dr. Adams with a grain of salt in his proposed electrical air line between St. Louis and Chicago, yet he believed that for suburban traffic electricity would yet be found to have advantages over steam. Mr. Selden said that the actual available help of the locomotive was but 30 per cent. of the theoretical, and under unfavorable conditions fell to 10 per cent., and that it was impossible to get as good results from a locomotive as from a stationary engine.

Mr. J. B. Stewart read his paper on "Block Signals," which appears in this issue.

Mr. Selden said that in Maryland the law required that either a flagman or signal must be placed at each crossing. He had made arrangements to substitute bells for flagmen. They now paid $18,700 per year for service that could be performed at a cost of $2,000 by the use of bells. The worst accidents they had occurred when the watchman was asleep. In Philadelphia they had 20 crossings guarded by bells, and the only accident they had was the killing of a horse. In this case the owner wished to have him killed as he needed a new horse and he got one.

Mr. Hammond stated that they had had similar accidents on the Missouri Pacific, but had not been able to prove that the bell was ringing when they occured.

At the afternoon session, on Wednesday, the following committees were appointed: Messrs. Selden, Greene and Gemmell, to revise the constitution; Messrs. Swift, Ford and Sholes, to prepare a new form of service card; Messrs. Reed, Fry and Ford, on arrangements for the next meeting; Messrs. J. B. Stewart, Gemmell and Adams, on topics, and Messrs. Selden, Leonard and Darlton, on acknowledgment for courtesies extended by the C., R. I. & P., the Denver & Rio Grande, the Union Pacific, the Atchison, Topeka & Santa Fe, the C., B. & Q., the Manitou & Pike's Peak Railroad Companies, the Colorado Telephone Company, the Commercial and Athletic Clubs, Wyckoff, Seamans & Benedict, and many others.

The formal business of the meeting being finished, Ex-President Jones called President Korty to the chair, and, in transferring the gavel, said that he desired to express his satisfaction at the most splendid success they had achieved at this meeting, which was, of course, due to the large attendance of members and their enthusiasm. President Korty, in reply, said that he was deeply sensible of his inability to fill the position thus vacated, but would do his best. The meeting then adjourned to June 20, 1893.

The following is a list of members and guests in attendance at the meeting, most of whom were accompanied by ladies.

MEMBERS AND GUESTS IN ATTENDANCE.

C. S. Jones, Illinois Central, Chicago.
A. R. Swift, C., R. I. & P. R. R., Chicago.
C. Selden, B. & O. R. R., Baltimore.
O. C. Greene, No. Pac. R. R., St. Paul.
C. M. Dugan, Ill. Central R. R., Jackson, Tenn.
P. W. Drew, Wis. Central R. R., Chicago.
M. Magiff, Central Vt., St. Albans, Vt.
H. C. Hope, C., St. P., M. & O., St. Paul.
G. L. Lang, N. Y. & N. E. R. R., Boston.
M. B. Leonard, Ches. & O. R. R., Richmond, Va.
C. A. Darlton, R. & D. R. R., Atlanta, Ga.
J. L. Orbison, C., H. & D., Cincinnati, O.
J. C. Ford, C., St. P. & K. C., St. Paul.
G. R. Kimball, B. & O., Newark, O.
G. T. Williams, N. Y. C. & St. L., Cleveland, O.
L. B. Foley, D., L. & W., New York.
J. T. Gibbons, D., L. & W., New York.
K. McKenzie, M. & O., Jackson, Tenn.
H. C. Reed, M. L. S. & W., Milwaukee.
J. B. Stewart, West Shore, New York.
W. W. Jackson, N. Y. & N. E. R. R., Providence, R. I.
R. J. M. Danley, C., H. & S. Columbus, O.
W. B. Ward, B., C. R. & N., Cedar Rapids, Ia.
W. D. Vincent, B. & O., Pittsburgh.
S. K. Bullard, M., K. & T., Sedalia, Mo.
U. J. Fry, C., M. & St. P., Milwaukee, Wis.
W. J. Holton, C. & W. I., Chicago.
D. H. Caldwell, N. Y., C. & St. L., Fort Wayne.
G. C. Kinsman, Wabash R. R., Decatur, Ill.
H. C. Sprague, K. C., Ft. S. & M., Kansas City.
O. B. Corty, U. P. R. R., Omaha, Neb.
C. G. Sholes, A., T. & S. F. R. R., Topeka, Kan.
A. R. Lingafelt, C., R. I. & P. R. R., Topeka, Kan.
W. P. McFarlane, F. E. & M. V., Omaha, Neb.
C. S. Rhoads, C., C., C. & St. L., Indianapolis, Ind.
F. M. Duncan, D. & R. C., Denver, Colo.
W. W. Ryder, C., B. & Q. R. R., Chicago.
Geo. B. McCoy, Ill. Central, Memphis, Tenn.
J. J. Dickey, Supt. W. U. Tel. Co., Omaha, Neb.
R. B. Gemmell, A., T. & S. F., Topeka, Kan.
E. R. Adams, P. & R., Reading, Pa.
J. J. Burns, D. & R. G., Pueblo, Colo.
E. W. Hammond, Missouri Pacific, St. Louis, Mo.
E. E. Rittenhouse, Colo. Midland, Pueblo, Colo.
J. W. Lattig, Easton, Pa.
R. S. Bogart, New York.
W. S. Logue, New York.
H. F. Boughton, Decatur, Ill.
J. B. Shaw, Jamestown, N. Y.
Ralph W. Pope, New York.
T. D. Lockwood, Boston.
T. J. Smith, New York.
H. R. Wilson, Chicago.
D. C. Matheson, Flint, Mich.
T. R. Taltavall, New York.
G. W. Crook, Valparaiso, Ind.
W. P. Willoughby, Chicago.
C. P. MacKie, New York.
W. C. Gilham, Kansas City.

It was expected, when Denver was selected for the holding of the eleventh meeting, that the social features of the occasion would be unusually conspicuous. The various railroad companies centering in Denver vied with each other in offering the members every opportunity to view the natural wonders of Colorado, as well as the engineering skill which has enabled man to triumph over natural obstacles. Lack of time prevented the acceptance of but a small proportion of these courtesies. Friday was devoted to a trip over the Clear Creek division of the Union Pacific Railroad, which embraces the famous Georgetown loop. The Mendota silver mine was also visited. Saturday the members were the guests of the Denver and Rio Grande Company and the Manitou and Pike's Peak Railroad, and were taken over this famous cog-wheel line. Upon their return the Colorado Midland Railroad Company ran a special through Ute Pass and return for their entertainment, and on Sunday the Denver and Rio Grande gave them a trip through the Royal Gorge to the Hanging Bridge. One of the most interesting events at Denver was the presentation of a solid silver salad bowl, fork and spoon, to Mr. and Mrs. Swift, in remembrance of the thoughtful preparations for the trip and their watchful attention to all who had the pleasure of enjoying the many courtesies extended to the Association during its visit to the Centennial State.

Exhibits.

Distance did not interfere with the enterprising exhibitors, who, in their efforts to show the merits of their various exhibits, added much to the interest and importance of the meeting.

The Leonard train order signal and the Leonard block signal were exhibited by the Electric Secret Service Company. Working models of these signals were shown in combination with the automatic selective apparatus of the Electric Secret Service Company. Other applications of the latter were shown adapted for telegraph, electric light and power service. General Manager C. P. MacKie was present and made many new friends among the railroaders.

A working set of the Edison Phonoplex was shown in actual operation, being connected with the line to Canon City. Current was supplied by the Edison-Lalande battery, various sizes and forms of which were also on exhibition.

The Dulaney self-winding clock operated by two cells of gravity battery attracted much attention, it being in practical use on the C., B. & Q. R. R.

The Gill-Alexander Electric Manufacturing Company was represented by W. C. Gilham, who had arranged a working exhibit of the system of selective apparatus manufactured by that company.

The iron gravity battery manufactured by the Standard Battery Company, 324 Dearborn street, Chicago, was shown by Dr. A. P. Willoughby. In this battery an iron electrode is substituted for the zinc as ordinarily used. A secret compound is used for starting it. The battery is now being tested by various companies.

The "Excessive Current Protector," invented by I. N. Miller, of Columbus, O., was on exhibition and explained by Mr. Leonard.

Samples of insulating fibre were shown by the Luminar Fibres Goods Company, of Boston.

The Block Signals of the Present, and What is Required for the Future.

READ AT THE ELEVENTH ANNUAL MEETING OF THE RAILWAY TELEGRAPH SUPERINTENDENTS, DENVER, COLO., JUNE 16, 1892, BY J. B. STEWART.

A great deal has been written on this subject during the past year; railroad officers have given more attention to it than ever before, and the American Railway Association (formerly called the General Time Convention) has appointed a committee to consider and recommend a standard block signal system, involving as it does the very safeguard to the reputation of any railroad that attempts to meet the demands of the traveling public for high speed and safe transportation.

The English or Sykes system is the one now generally in use. Does it meet the requirements and give the necessary security? To answer this question let us first give, briefly, the method of protecting trains by this system, with which, however, a great many of you are familiar.

Each office is supplied with a semaphore signal; the lever controlling the arm is locked—an operator desiring to give a signal to an appoaching train must ask the operator in advance to unlock his lever—the signals between block stations are given by bell code on some roads, and on others, where the locking arrangement is not used, by the regular Morse code. As soon as the train passes into the next block, the operator places his signal to indicate danger, the lever being again locked. He then signals the operator in the rear that the train has passed out of the block. On crowded roadways, and especially where trains are "closing up" on approaching the great terminal points, these signals must be given instantly so as to not detain the following train. Herein lies a very great danger. This was brought more forcibly to my mind by reading the very able article written by Mr. Theo. N. Ely, General Superintendent of Motive Power of the Pennsylvania Railroad, and published by *Scribner's Magazine* for March, on the subject of train speed. Mr. Ely claims that "speed at the rate of 100 miles an hour is no longer a question of motive power, but one of transportation facilities and methods," and, after calling for a perfect road-bed, "the alignment almost free from curvature, etc.," he says, "100 miles per hour is made possible, but only upon the fulfillment of one other condition, namely, a *clear track* ahead." All talk on the question of such a high rate of speed may appear to be based on theory, but if you will consider for a moment that our "limited" trains of to day are scheduled at an average of about 53 miles per hour (this, of course, includes all stops, adding the time thus lost to that which is lost in climbing heavy grades, running slow through cities, towns, etc.), these trains must maintain an average of more than 60 miles per hour and this means 75 and 80 per hour on the best running grounds. And, further, the high speed of our fast freight trains and the distance covered by such trains after the brakes have been applied for an emergency stop will, I think, convince all of you that we are surely and rapidly advancing to the high limit now set and that our block signals have not kept pace with it. This brings up the question how soon, after receiving warning of danger, a train running at this speed can be stopped. Accepting the figures given by Mr. Ely (for I am sure we recognize in him a competent authority), it is estimated that a train running at the rate of 60 miles per hour with full braking weight of the train and rails in the most favorable condition, could be brought to a full stop in 900 feet, at 80 miles per hour in 1,600 feet, at 90 miles in 2,025 feet, and, finally, at 100 miles per hour in 2,500 feet.

You will observe that these figures are based upon the most favorable conditions, but such conditions cannot be relied upon. Starting a train, either passenger or freight, from Buffalo, with every part in perfect order and weather clear, the load may be heavier on one day than on another, making it harder to stop, and before that train reaches New York the break shoes are worn, the leverage is strained and pulls unevenly, the track is wet and slippery along the Hudson, and the fog obscures the signal until the train is very close to it. Should we not then base our figures on the most unfavorable conditions, and, again quoting Mr. Ely, ask "that the train receives its warning at least three-quarters of a mile before it must halt?" Now, coming back to the point of danger, the operator has "cleared" his block, but the train has only gone 1,000 feet into the next block, and, from some cause, has stopped. Before this is discovered the fast train following has been given a clear signal at the station in the rear and covers the 4,000 feet between the two signal stations in about 27 seconds; there the engineer finds the signal in danger position and applies the brakes, but, according to Mr. Ely's figures, the momentum and weight

of that train will carry it at least 1,500 feet beyond where the preceding train has stopped and the result is a collision.

An effort has been made to meet these new conditions by placing a signal back into the block (commonly called the overlap) to indicate the position of the home signal, this is also operated by a lever, interlocked and included in the combination governing the system. This will lessen the danger, but with this mechanical arrangement the signal cannot be placed back far enough to entirely eliminate the danger. Another point of danger is that an operator can unlock the signal in the rear if his own lever has been unlocked, and thus permit a second train to come into the block. The Hall Signal Company now have an improvement on the Sykes system which covers this point and is arranged so that a train in passing out of the block depresses a track instrument; this is connected electrically with the unlocking device, so that it is necessary for at least a part of the train to pass out before the lever can be unlocked.

There is still another and greater chance for an error in this system, as well as in all other non-automatic systems. We must depend upon the operator to see that *all* of the train passes out of the block. As you well know, all trains carry "markers" to denote the last car—the operator is expected to see the markers and to not report the train clear until he does see them. If the train has broken in two parts and the first part goes by the office and the operator fails to notice the absence of markers, it is quite probable he will report "train clear," and the following train will be admitted to the block under a clear signal to find the detached portion of the preceding train unprotected by a flag, as the trainmen depend upon the block signal, and do not get very far from their cabboose. It is claimed for the Sykes system that two persons must make a mistake before a wrong signal can be given. This is true in so far as the unlocking part is concerned; but as I have shown in the case of a train stopping soon after passing the block, an accident is possible even with all regulations obeyed, but in the last case, *one* man makes the error by failing to see the markers.

The arrangement of the pneumatic system seems to cover these points, but I believe the same protection is afforded by any other system that is operated by a track circuit, and with very much less machinery to get out of order.

If we then conclude that the present systems must be improved to insure absolute safety, what will be the system of the future?

Will it be entirely automatic, by means of the rail circuits?

Will it be electric pneumatic, with an attachment to the last car, or will it be, as a writer in the *Railway Equipment Guide* for April suggests, "A system that will display signals continuously throughout each block, so that the signal to proceed or stop will always be in view of the engineer." This idea strikes me very favorably. With such a system the operator controls the line of signals for a certain distance in the blocks each side of his station. In any event, it is my opinion that electricity will play an important part in the block signal of the future, and as the superintendent of telegraph, or division operator, is the man to whom electrical matters are entrusted, I venture to bring the matter before the members of this Association that we may keep in advance of the movement, and in the hope that some one of you will be fortunate enough to devise the system that will meet all the conditions.

My own experience and observations have led me to believe that a combination automatic and manual will meet the requirements, and, I would suggest, that the blocks be not less than three quarters of a mile, the home signal operated by a lever, and signals operated by electricity and gravity or air pressure placed 1,000 or 1,500 feet apart throughout the block, the circuit connecting these signals to be also connected with the lever at the home station, so that in moving the lever to place the home signal at danger the circuit will be opened and the signals go to gravity, or weight; these signals will give ample notice of the position of the home signal and protect a train stopping just beyond a block station, it also admits of giving notice to the train should the block ahead clear after the train passes the distant signal, and schedule speed may be resumed before the train reaches the home station.

To eliminate the chance of an operator unlocking the lever while any part of the train is in the block, I would add to the above the connecting and insulating of one line of rails throughout each block, this rail to be free from contact with cinder ballast (stone ballast gives best results), running taps from this rail circuit to one side of the metallic line circuit, which is used to unlock the lever at the office in the rear.

A train passing over the block will ground the side of the circuit connected by taps to rail, close the relay, and the local of this relay will lock the lever which operates the home signal, open the circuit of the block in rear, and will remain so until the last pair of wheels connected by a metal axle passes out of the block. With this arrangement it will not be essential that the operator see the "markers."

There will, of course, be objections raised by railroad officers to depending upon electricity, and their past experience may justify them in doing so, but I believe that it *can* be depended upon, and in my opinion the day is not far distant when it will be.

All failures can, undoubtedly, be traced to defective designs or instruments, failure through inattention to the batteries, or perhaps all together. We have track circuits, both open and closed; also electric signal circuits, normally closed, and I require that a closed circuit battery be renewed every fourteenth day, no matter what its conditions may be, new zincs placed in the track battery and using the cleansed zincs in the local circuit.

With this systematic way of handling the batteries, and reliable men to do the work, and to watch the circuits, there will be no failures of the electrical parts. We have been experimenting with the Beatty zinc on our track circuits with very good results. The zinc is self-cleaning and always presents a clean surface, and, if the solution is kept at a proper strength, a uniform current is given out, so that changing the adjustment of relays is unnecessary. We are also trying them on normally open circuits, and expect to use them to replace Leclanche cells with gravity, as they do not run out if short circuited.

The first cost of the Beatty zinc is a little more, but a less number of cells are required, and the zinc does its work until nothing is left but the stem.

Since we arrived here, our attention has been called to a new battery, which, if further tests prove as satisfactory as those already made, the zinc will no longer be needed, and a long step taken towards the ideal gravity battery.

With a good and reliable battery, I believe that electric signals and highway crossing bells will come more generally into use, and, by requiring strict attention from men in charge, our officers will soon lose their distrust of electrical appliances and recognize in them very useful and economical adjuncts to the service.

A New Deal.

The firm of Pierce & Thomas having gone out of business, F. M. Pierce having purchased the interest of R. H. Thomas—their successor, the Pierce & Miller Engineering Company, will continue the business at the old stand, 42 Cortlandt street, New York city.

F. M. Pierce, the president of the company, has associated with himself the valuable men in the old firm, *i. e.*, John D. Miller, vice-president, formerly special partner in the firm of Pierce & Thomas, and for many years associated with Mr. Pierce in the management of the Ingersoll Rock Drill Company, of New York, and Kennedy & Pierce Machinery Company, of Denver, Colo.; F. Schmerber, chief engineer, also with the old firm, and with Mr. Pierce as designing and constructing engineer of the Ingersoll Rock Drill Company; W. B. Hadley, electrical engineer, formerly superintendent of installation department of the Edison Electric Illuminating Company, New York; W. H. Stalnaker, secretary and treasurer, formerly treasurer of the Valentine Varnish Company, New York.

This new company will continue as the general sales agents of McIntosh & Seymour, automatic engines; Porter Manufacturing Company, engines and boilers; T. M. Nagle and the Pennsylvania Boiler Works, engines and boilers; Young-Brennan Crusher Company, rock and ore crushers.

It will also go more extensively into the business of engineering and contracting for complete steam plants for electric railway lighting and manufacturing purposes, also for mining machinery and the construction of plants for the equipping of mines and for the concentration and milling of ores, and in all work the new company will adhere closely to the policy adopted by Pierce & Thomas, *i. e.*, of furnishing first class machinery specially adapted to the work it has to perform, and first-class engineering and construction work, where contracts are to be executed, having in view, first, the economical and convenient operation of the plant, in line with the best engineering practice.

With the experience already secured along the lines of mechanical and engineering practice, these gentlemen will doubtless be factors in the growing electrical industry. We extend to this old new concern our best wishes for a continued successful existence.

Individual Selection of Electrical Objects.

READ AT THE ELEVENTH ANNUAL MEETING OF THE RAILWAY TELEGRAPH SUPERINTENDENTS, DENVER, COLO., JUNE 16, 1892, BY S. S. BOGART.

Individual selection, as applied to electrical objects, has some interesting features. It is strikingly singular that it has not received more attention at the hands of the eminent persons here present. The application of a selector to any circuit to reach any of the objects desired, and the necessity for such a device, is doubtless as apparent to you all as is the application of the current to telegraph, lighting and power. In the individual call-bell circuit we have a combination of electrical impulses on a transmitter (or sent by an ordinary Morse key) and selector shaft that correspond with each other. Any other than the combination for that instrument throws in a false combination, upsets the pawls and restores the selector's sector to zero. This principle, applied to all the other selectors on the circuit, acts in a like manner. The call-bell set consists of a key, transmitter, relay, sounder, answer-back and bell. When the combination has properly completed its phase the answer-back is vitalized, and it automatically transmits the assurance back over the wire that the object has been reached and the bell is ringing. The sounder is always in circuit, except when the bell is ringing, then all of the battery is transferred to the bell. But three cells of ordinary Callaud or gravity battery are necessary for the entire circuit. There are no short circuits; always a magnet's resistance interposed, consequently, the battery is in a normal condition. Does not waste under local action or wear out through short circuiting. The advantages of this system in saving time in calling offices has been carefully gone over, and, as it is an undisputed fact that upwards of one-third of the time is spent in calling, the fact is apparent that the general managers will bless us all for not asking them to build additional expensive wires on which we are to spend one third of the time calling the offices. The greater the number of wires the more difficult the problem of raising the one or two operators at some points. As we increase the number of wires on the poles we increase the cross-fire or induction and escape. When the relay adjustments change to such an extent as to affect the sounder, the selector will work so long as the armature of the relay moves to its contacts. Other arguments, too exhaustive to advance here, could be offered in favor of the adoption of such a system. Fearing that they might smack too strongly of bias in favor of my own, I prefer to have my associates set the bias from another direction.

FOR ELECTRIC LIGHT AND POWER USE.

In connection with the use of arc lights, the selector system affords a simple and effectual means of starting and extinguishing lights at various hours upon the same circuit. Arc service, as is well known, is usually run on "day," "nine o'clock," "midnight," "all-night," and other circuits, and frequently all these may be found on one block or street. This multiplicity of circuits and variety of uses lead inevitably to greater expense, increased risk and difficulty of operation. The application of the "combination" device permits the several classes of lights to be operated on one circuit and the central offices to control each separate class, or each group in that class, as desired. Incandescent circuits and those used for the transmission of power are equally subject to the control of the "combination selector," and in all branches of lighting and power work the system may be applied to advantage. The automatic attachment both ensures safety of operation and announces to the transmitting point the completion of the desired work, while the economy resulting from its use on circuits or wide extent of great activity will be an important consideration to every company employing electric lights or power.

FOR FIRE ALARM AND POLICE SERVICE.

The use of these instruments on the police and fire circuits of cities enables an alarm to be confined to such posts or stations as are at the moment required, instead of arousing the entire department, as is generally the case. The call may be limited to a single station, or to a group of them, or to a whole district, according to the "combinations" employed. The immense saving of time, money and fatigue to men and horses by the adoption of such an individual signal will be readily appreciated by all familiar with the present system in vogue in our Departments of Public Safety. The chief of a department can direct his summons at pleasure to the stations he wishes to reach, and, by using a number of combinations, can employ as many different signals as necessity requires.

FOR TELEGRAPH AND TELEPHONE PURPOSES.

In "village and town" telephone exchanges, and upon long distance and all private lines, the application of these selectors will ensure complete privacy by the exclusion of all intermediate telephones. In circuits of minor importance the central office may be entirely dispensed with, each subscriber being supplied with his own combination and those of the others upon the same circuit. This system permits calls to pass noiselessly through intermediate telephones, thus avoiding the vexatious ringing of all bells which now occur when one subscriber sends a signal to another. The fact that no message will be audible to any subscriber other than the one immediately interested opens what is practically a new field for the development of the telephone.

FOR NAVAL AND MILITARY PURPOSES.

While for obvious reasons it is not convenient to discuss in detail the use to which this system is now applied in connection with military and other government service, it may be pointed out that it (1) gives at any moment to headquarters, or other proper authority, the control of the line; (2) allows confidential intercourse between any two points on a circuit without including intermediate stations; (3) gives to the commander of a battery of guns or torpedoes the faculty of discharging at will any one weapon upon a circuit without danger of affecting the others, thus dispensing with the necessity of having a separate wire for each individual weapon; (4) places in the hands of headquarters or its delegates the exclusive power of affecting any electrical circuit, by giving them the means of changing the combinations of the various stations at pleasure, by which no station can be actuated, except by one familiar with the respective "combination."

A more recent connection, and one that is received with marked favor by leading railroad men, is its application to the Leonard interlocking block signal and the Leonard train order signal. In the former it enables us to use a wire for other than blocking trains, thus saving a duplication of wires. In the latter the train dispatcher is master of the situation, and controls as many signals as he desires from his table, and receives assurance of the fact from the return signal that the object sought has been attained.

Telegraph Strike in Spain.

A cablegram from Madrid states that the telegraph operators throughout Spain went on strike June 21. Their grievances are long hours, low wages and irregular payment. They have a thorough organization, made with a view to the present strike. The wires in Madrid and some other leading places are being operated by telegraphers who are in the military service and must obey orders like other enlisted men, although they sympathize with their fellows. Great confusion prevails owing to the strike.

Fire in the Edison Building.

The woodwork in the executive offices of the Edison General Electric Company, on the seventh floor of the Edison building, which runs through from Broad street to New, caught fire about two o'clock in the morning of June 21. The building is fireproof and the flames were confined to the offices in which they originated. The total loss is estimated at $8,000, and is covered by insurance.

A second fire broke out on the eighth floor about 1 A. M., June 24. It was extinguished with trifling loss. The firemen think an incendiary is at work.

A Fine Catalogue.

The E. W. Bliss Company, Limited, of Brooklyn, N. Y., owners of the Stiles & Parker Press Company, of Middletown, Conn., have issued a very creditable catalogue illustrating and describing the products of the two companies. The catalogue consists of about 400 pages, is handsomely illustrated with wood-cuts and expensively bound in semi flexible covers. These companies make a specialty of designing and manufacturing machinery for special purposes, and are always glad to estimate on such work. A few of the machines described in this new catalogue, which is one of the most worthy productions of its class, are drop hammers, forging presses, dies for all purposes, lathes, vertical milling machines, boring mills, screw presses and lever and pendulum presses.

The book constitutes by far the best record of what has been accomplished in the construction of presses, dies and special sheet metal machinery, besides combining the patterns, experience and facilities of the two companies named.

KINDRED INTERESTS

The Waterbury Brass Company, of Waterbury, Conn., are putting up their new wire mill, which will be of iron designed and furnished by the Berlin Iron Bridge Company, of East Berlin, Conn. The rolling mill will be 100 feet wide by 160 feet long, with a wing (to be used for drawing wire) 40 feet wide by 230 feet long.

General Electric Company.—The following contracts have been closed by the Boston office of the General Electric Company since June 1: Oswego Street Railway Company for additional equipment; Concord Street Railway Company, Concord, N. H., for additional equipment; Brockton Street Railway Company, Brockton, Mass., for additional equipment; Biddeford and Saco Street Railway Company, Biddeford, Me., for additional equipment; Hartford and Wethersfield Horse Railway Company, Hartford, Conn., for original equipment. A contract has also been closed by the Philadelphia office with the Lake Roland Elevated Railway Company, of Baltimore, Md., for 25 double motor Edison No. 16 car equipments. They have also closed a contract with the Binghamton and Port Dickinson Railway Company for motors and generators.

Among the important contracts closed by Manager Barnes, of the Westinghouse Company, in New England, since June 1, is that of 1,000 direct current incandescent lights for illuminating the immense works of the American Screw Company, Providence, R. I. In the electric street railway department more than the usual activity has existed since June 1. Among the important contracts recently taken for car equipment are the following: Natick and Cochituate Street Railroad, four cars with one 25 horse-power single reduction motor each, cars to be running within 10 days; Hartford and Wethersfield Street Railroad, four large cars with two 20 horse-power single reduction motors each, and the Wakefield and Stoneham Street Railroad—now in process of construction—four large cars with two 20 horse-power motors each. It is predicted that the cars on last-mentioned road will be in operation by the last week in August.

The Ball Engine Company, Erie, Pa., report the following shipments in the last four weeks: F. H. Leggett & Co., New York city, one 80 horse-power; Lowell M. Palmer, New York city, two 130; H. Ward Leonard & Co., New York city, one 130; Electric Light Co., Coulee City, Wash., one 25; Cooley & Vater, Minneapolis, Minn., one 100; Silver Bow Electric Co., Butte, Mont., one 150 horse-power tandem; Hotel St. Louis, Minnetonka, Minn , one 60 horse-power; Oakland Street Railway Co., Stockton, Cal., three 200 horse-power tandem; Edison General Electric Co., Joplin, Mo., one 35 horse-power; Baltimore Traction Co., Baltimore, Md., two 130; Washington Park, Chicago, Ill., one 35; Pittsburgh Iron and Steel Engineering Co., Pittsburgh, Pa., one 50; Risdon Iron Works, San Francisco, Cal., one 35; Brooklyn Cooperage Co., Brooklyn, N. Y., two 130; Hotel Vendig, Philadelphia, Pa., one 50; Schuylkill Electric Railway Co., Pottsville, Pa., one 300; Rome Street Railway Co., Rome, Ga., one 130; Rome Street Railway Co., Rome, Ga., two 100; Duluth Street Railway Co., Duluth, Minn., one 50; Pittsburgh Locomotive Works, Pittsburgh, Pa., one 100; Curtis & Dean, New York city, one 80; Risdon Iron Works, San Francisco, Cal., three 200 horse-power tandem.

'Tis Sad; 'Tis True.

We boast in these our modern days
Of Edison and carbon tips.
And laugh whene'er we chance to think
Of our ancestors' tallow dips.

But after all a tallow dip,
Although its flame be dim and weak,
Is worth a dozen electric lamps
To find out where the gas-pipes leak.

—*N. Y. World.*

Something New! One, two, three, and four spindle drills for light work.

DRILLS

The most useful patented improvement in drill presses for years is applied.

SENSITIVE

Spindles driven with single, endless belts. Large driving pulleys, tightener and variable speeds provided.

Over 1,000 in use. Buy the **latest** and **best.** Special machinery to order. Catalogue of fine tools free.

Dwight Slate Machine Co.

HARTFORD, CONN.

THE NEW YORK OFFICE of the Consolidated Electric Storage Company, 120 Broadway, is the sole agency for the sale of storage batterics for New York and vicinity. Purchasers desiring to secure the best terms should apply at that office to

E. J. MOORE, Manager.

A CARD TO THE STEAM-USING PUBLIC.

It having been brought to my attention within a day or two that printed matter is being circulated wherein my name appears as general manager of the "Hussey Re-Heater and Steam Plant Improvement Company," I would state that I have not been connected with that company for over two years.

For your further information I would advise you as follows:

In 1883, Mr. Hussey patented two re-heaters for re-heating steam exhaust steam. These re-heaters were manufactured and sold by Mr. Donaldson and Mr. Hussey, conjointly, afterwards by Mr. Donaldson, and in 1884 by the Donaldson Heater Company, of which I was secretary. Within a few months I, individually, secured the exclusive right to manufacture and sell them.

In 1888, on the strength of certain promises, I organized, with others, the "Hussey Re-Heater and Steam Plant Improvement Company," of which I was general manager. But after two years with that company I resigned as its general manager, at the same time withdrawing such interests as I had, and since then I have had no further connection with it.

I intended at the time to open an office for the continuation of my business, but while making the necessary arrangements I concluded to spend a short time in the electrical business, since I knew very little about electricity, and realized that it was to play an important part in the steam business. I entered the Edison Company and only recently left it.

How long my name has been used in the manner mentioned I do not know, but I wish, even perhaps, at this late day, to state that I am not interested, directly or indirectly, in any business except my own.

Very truly yours,

S. D. BREWER,

Hussey Re-Heater System, 50 B'dway, N. Y.

June 18, 1892.

ELECTRIC LIGHT—SEALED BIDS.

Sealed bids, with Plans and Specifications for the furnishing of Sixty (60) Arc Lights of Eight Hundred (800) candle-power each; or for the furnishing of One Hundred and Twenty-five (125) Incandescent Lights of Forty (40) candle-power each (Separate Bids), for lighting the streets of the Village of Hempstead, Queens Co., N. Y., will be received by the Board of Trustees of said Village on or before the 14th DAY OF JULY, 1892.

The Board of Trustees expressly reserves the right to reject any and all bids if they deem it to the interest of the Village to do so. The accepted bid must be accompanied with a certified check for Two Hundred and Fifty Dollars ($250) payable to the order of S. A. Smith, President of the Village, to guarantee the completion of the work. In event of failure to complete the work according to the plans and specifications, the said amount of Two Hundred and Fifty Dollars ($250) to be forfeited to said Village of Hempstead. Lights to be suspended in center of streets.

By order of Board of Trustees,

S. A. SMITH, President.

Dated June 14, 1892.

MACHINERY IN STOCK.

Engine Lathes, 10 in. x 4 ft.; 11 in. x 5 ft.; 12 in. x 6 ft.; 14 in. x 6 ft.; 16 in. x 6 ft.; 18 in. x 8 ft.; 20 in. x 8 ft., with tapes attachment; 22 in. x 12 ft. and 14 ft.; 24 in. and 26 in. x 16 ft.; 30 in. x 10 ft. and 18 ft.; 36 in. and 38 in. x 20 ft.; 42 in. x 12 ft.; 27 in. x 32 ft.; 88 in. x 31 ft.; 96 in. x 20 ft. Fox Lathes, 13 in. x 5 ft.; 14 in. x 5 ft.; 15 in. x 6 ft.; 18 in. x 6 ft. Turret Lathes, 12 in. x 5 ft.; 14 in. x 5 ft.; 15 in. and 16 in. x 6 ft.; 18 in. x 6 ft.; 36 in. x 8 ft.

Planers, 16 in. x 16 in. x 3 ft.; 20 in. x 20 in. x 4 ft.; 24 in. x 24 in. x 6 ft.; 30 in. x 30 in. x 6 ft.; 36 in. x 36 in. x 10 ft.; 42 in. x 42 in. x 12 ft.; 44 in. x 48 in. x 22 ft.; 60 in. x 49 in. x 24 ft.

Friction Shapers, 15 in., 16 in., 20 in., 22 in., 32 in.

Crank Shapers, 6 in., 8 in., 10 in., 12 in., 13 in., 16 in., 17 in., 20 in., 24 in., 28 in.

Screw Machines, Nos. 1, 2, 3, 4, with or without Wire Feed.

Screw Machines, Nos. 5, 6, 7, 8, Power Feed.

Presses, Nos. 51, 52, 53, Ferracute; Nos. 1, 2, 3, Stiles & Parker.

5 Lincoln Pattern Millers, No. 2.

Hand Millers, Nos. 1 and 2. 3 Cam Cutters.

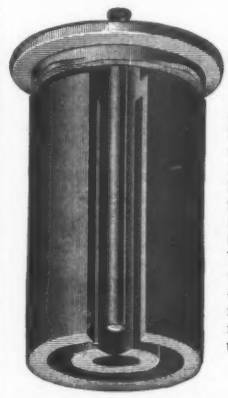
Bolt Cutters, ¼ in. to 1 in., ½ in to 2 in.

2 Profiling Machines. 1 36 in. and 48 in. Gear Cutter.

C. D. and E. Horizontal Boring Machine. Newark Machine Tool Co.

Send for List of New and Second-Hand Machinery in Stock.

PRENTISS TOOL & SUPPLY CO., P. O. Box 3362, 115 Liberty Street, New York. 59 South Canal St., Chicago, Ill.



THIS is a cut of the Law Battery Double Cylinder Carbon Element attached to cover with zinc. It has 147 square inch carbon surface. The element is everlasting and is so guaranteed. Why use a battery with a chemical depolarizer that needs frequent renewal of the negative element?

LAW BATTERY COMPANY,
85 JOHN STREET, N. Y.

Robb MacKie,
CONSULTING ELECTRICAL ENGINEER,

Neave Building,

CINCINNATI, O.

PATENTED.

THE DANDY BELL

Has been tested on one cell of battery to 14 without changing the adjustment, and rang clear every time. It rang loud and clear on one cell of battery through 500 feet of No. 18 wire. One cell of No. 2 Samson battery rang 20 at the same time, and one cell rang seven through 100 feet of wire. Every Bell tested before leaving shop. Sample sent by mail, 50 cents.

THE TIME ELECTRIC CO.,
C. O. BARTLETT, Gen. Manager,
67-71 South Water St., CLEVELAND, O.

THE GRAVES ARC LAMPS.

FOR ALL CIRCUITS. HIGH AND LOW TENSION.
BEST AND CHEAPEST. WRITE FOR PARTICULARS.
DON'T PURCHASE UNTIL YOU SEE THEM.

***GRAVES TRANSFORMERS** are the lightest in Weight and highest in Efficiency.*

The W. D. GRAVES Electrical & Manufacturing Company,
CLEVELAND, OHIO.

AN ELECTRICAL LIBRARY.

OPPORTUNITY FOR BEGINNERS.

A Comprehensive, Carefully Selected, yet Inexpensive, List of Instructive Electrical Books.

In response to the many inquiries from all parts of the country as to the best books for those who are desirous of becoming posted in the rudiments of Electricity in its various branches, and in an endeavor to afford beginners as wide a range of reading as possible for a comparatively small outlay, the Book Department of the **ELECTRICAL REVIEW PUBLISHING COMPANY** makes the following offer:

We will send by *express, prepaid,* on receipt of **$15.00,** fourteen books by the most popular authors, especially adapted for a course of elementary reading, including the **ELECTRICAL REVIEW** for one year, as follows:

PRACTICAL ELECTRICITY, - By *Ayrton*
ELEMENTS OF ELECTRIC LIGHTING, - - - - - By *Atkinson*
DYNAMO TENDER'S HAND-BOOK, By *Bult*
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ELECTRICITY FOR ENGINEERS, By *Desmond*
THE TELEPHONE, - By *Dolbear*
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